UNCLE SAM'S ADVICE TO HOUSEWIVES

COMPILED FROM

GOVERNMENT BULLETINS

IN TWO VOLUMES

BY

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VOL. I — 2

NEW YORK
THE CHRISTIAN HERALD
BIBLE HOUSE

U. S. FOOD ADMINISTRATION

WASHINGTON, D.C.

October 11, 1917.

The Christian Herald in gathering together in book form a number of the important bulletins of the Department of Agriculture, together with "Ten Lessons on Food Conservation" published by the U. S. Food Administration, is performing a distinct service in the present emergency.

U. S. FOOD ADMINISTRATION.

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DEPARTMENT OF AGRICULTURE
WASHINGTON

October 25, 1917.

Mr. Theodore Waters,
Secretary, The Christian Herald,
New York City.

Dear Sir:

I have your letter of October 15, in which you announce your purpose to publish a two volume set of bulletins of the Department of Agriculture. I can see no objection to the use of the Department's publications under the conditions indicated in your letter. I think it important, also, that your volumes should carry a specific statement to the effect that the bulletins included therein may be secured directly from the Government, many of them free of charge. The following sentence is suggested for this purpose:

Many of the publications listed herein may be obtained free upon application to the United States Department of Agriculture, Washington, D. C. Others may be obtained from the Superintendent of Documents, Government Printing Office upon the payment of a specified sum.

Respectfully,

D. F. Houston

Secretary.

UNITED STATES FOOD ADMINISTRATION

Extracts from

Ten Lessons on Food Conservation

FOOD THE DECIDING FACTOR

This year there is not enough food in the world for the world's needs. This is the fact, whether the war be long or short and regardless of its outcome.

Our allies must have more food than they can raise, and we must send them more than we can readily spare. To do this requires a few definite changes in our daily habits, but they can easily be made. Neither producers nor dealers nor consumers can effect this alone. The women who administer our households can not bring it about. It can not be done by legislation. Only by cooperation—universal, generous, whole-souled, decisive—can we do it. This cooperation must begin in the home. Housewife, father, and children are equally concerned and equally under obligation to enter the partnership. The outcome of the war and the welfare of the world depend upon their actively participating with others in this program.

Why is the great issue of success or failure in this

war dependent on the United States? What causes brought about this universal shortage of food?

First. Unkindness of nature. Late springs, droughts, hurricanes, poor conditions of rainfall, unexpected frosts, and periods of intense heat have played havoc with crops the world over. The season of 1916 will go down as one of the worst seasons in agricultural history. Our own crop of winter wheat is below normal. Argentina, normally an exporting country, claims to have barely enough wheat for her own needs.

Second. Reduced productivity of the soil in Europe. This condition has been brought about by bad management, unskilled work, and lack of fertilizers; and these in turn can be explained by the withdrawal of men from farm and field to army and factory, and the employment on the soil of overworked women, unskilled old men, and listless prisoners. Furthermore, the vicious submarine has sunk boat after boat filled with nitrates and fertilizers, conspiring to augment the pauperization of the earth, so that reduction in soil productivity was inevitable. For three years the world has been engaged in a ghastly competition of destruction and the soil is now beginning to take its revenge.

Such depletion in food supplies as these causes have brought about has made of food conservation an imperative necessity. One striking example of this is seen in the fact that in Germany to-day no food is fried. It is all boiled or stewed. Grease from the kitchen sink is carefully treasured, and soap, the basis of which is edible fat, has become a luxury of millionaires. Candles, another fat product, have disappeared. France and England also lack fats, though in a lesser degree, and unless the women of America realize the extreme importance of not wasting

and of not consuming one unnecessary bit of butter or other animal fat, we may later be in the same predicament.

But the problem of food production and conservation and the necessity for a food administration to deal with it would have arisen whether we entered the war or not. The nations of Europe that are now our allies have always been large importers of our foodstuffs. Because of their absorption in hostilities during the last three years they have been forced to buy from us an ever-increasing proportion of their foodstuffs. This demand must inevitably have grown more pressing, and our own spare resources as events progressed would inevitably have been exhausted.

Nor would the coming of peace solve the food problem. Most people are under the dangerous delusion that the mere ceasing of the firing of the big guns would bring bread to the world's table. That idea must be banished. It is essential that the nation should realize the permanency of our food problem. Peace, so far as we are concerned, means that to the demands of those who are now our allies would be added the demands of those who are now our enemies. We could not be indifferent to their hunger and so our diminished stores would be still more rapidly depleted.

Why, then, if food exhaustion is so universal, may we not rely on the speedy collapse of Germany's resistance? The answer is that before the war Germany and her allies were almost four-fifths self-supporting, whereas England was only one-fifth, France one-half, and Italy, at an optimistic estimate, perhaps two-thirds. Germany, moreover, was a nation given to over-eating. The reduction of her rations was at first a benefit rather than a detriment to her population.

Although in the last two years she has suffered severely her problem from the beginning has been only to increase her production by approximately 25 per cent. In spite of bad harvests she seems to have been able at least to meet the emergency, and if reports do not falsify she can do so indefinitely. She has possessed herself of what used to be the western fringe of Russia. She is cultivating much of Belgium and a large acreage of northern France. Her latest conquest of Roumania has given her possession of the plains around the lower Danube, perhaps the most fertile soil in the world. Further, Germany has a tremendous and intricate food organization and no one within her borders dares to waste a crumb. Considering all these facts it would be the height of folly for America to assume anything less than Germany's power to endure.

The position of our allies in western Europe is essentially different. Dependent, even in peace times, on importations from the outside, they drew their foodstuffs from almost every other country in the world. They can not now get supplies from central Europe—Germany, Austria-Hungary, Bulgaria, and Turkey—with which they are at war. Neither can they obtain grain from Roumania nor from Russia. With the best will in the world to aid, and presumably large stores of foodstuffs to sell, Russia is handicapped by the disorganization of her railroads. Even before the revolution her transportation system was paralyzed. To correct these conditions overnight is impossible. There will have to be a national rehabilitation before the allies can reasonably hope for help from their great free friend of the East. India and Australia, too, can send but a part of their surplus to England or France because of the shortage of tonnage caused

by the depredations of the submarines. Furthermore, the long trip from these far countries to the home ports is uneconomical and wasteful at a time when every inch of cargo space and every hour of cargo time has to be conserved. Nor can help be looked for from the great food-producing nations of South America, for they also have shared in the general crop depression, and it is doubtful if they will have enough even for themselves.

The United States is the greatest food-producing country. We have a larger acreage of land in crops than any other nation, except perhaps China. This acreage is nearly equal to that of all Europe, excluding Russia. For the moment Russia's crops count only for herself. From all this it will be clear that what our allies need from us in the way of cereals for human and animal food is enormous. Their total requirements are nearly 1,000,000,000 bushels. Of this amount native production and imports from other countries can supply but a small part; most of it must come from us. Yet this amount is far beyond any surplus that we shall have if we keep up our usual eating habits. We have never exported more than 500,000,000 bushels of cereals in a year, yet the needs abroad call for nearly twice that.

The moral is clear. We must reduce our own consumption. Our highest obligation in this war is to make sure that we do not fail our allies in their hour of need, just as our deepest duty to ourselves is to plan to-day, intelligently and patriotically, to provide against the possible shortage of next spring. It is within our power not only to protect ourselves and to create a surplus big enough to meet the most pressing needs of these people if we enforce on ourselves a few minor

economies. Already our allies have sacrificed their bravest and best for the cause which is now our cause. Their sacrifices must go on, but they must not be allowed to starve. However generous our giving, this summer and fall there confronts France and England and Italy the blackest and most agonizing winter they have ever had to endure. Such minor deprivations as we may suffer seem petty in comparison. Regulate ourselves we must if only to keep them in the trenches and to avert high prices, discontent, and general business and industrial depression in America this winter and next spring. Loyalty to those whose cause we have espoused and duty to ourselves counsel and oblige us to economy.

There is no suggestion of dictation in this appeal. The economies outlined impose no hardships. All must do their bit, but in applying the measures our nation's chief reliance must be on the women. They have the direction of the households of the land. In this, as in all wars, their great service is the all-important task of food conservation.

We would be blind to hard facts if we were not aware that many women throughout America, in the face of present high prices, regard the demand upon them for new economies as something of an impertinence. "How can you ask us to economize," many of them will say, "when already we have not enough money to buy things necessary to support life? What we want to know is not how we can cut down the amount of food, but how we can increase it."

To this just criticism it should be said plainly that the projected food administration will take definite measures to do away with food speculation where it may have existed, and to stabilize prices at fair levels. But

new economies must also be pointed out so that the whole people can extend the purchasing power of a dollar.

At the moment there is no actual shortage of food-stuffs in this country if we were only to feed ourselves. We have more than enough to feed ourselves; a great deal more. The terrific uplift in prices is due to the world's demand on our food surplus, the actual size of which is smaller than ever before in the history of our country. This has been, of course, an incentive to speculation and the advance has come about because of the haphazard way in which buyers have bid against each other until they raised the prices sky-high.

Under the new food-control régime it is hoped that prices can be kept from going higher if they are not reduced. It would be a serious error to suppose that any decrease in prices means any lessening in the need for saving and of economizing. In most European countries the Governments are dictating daily food rations for their inhabitants. The question of high or low prices must not blur our vision of the basic economic realities beneath. It is a matter of general supply. Put simply, it means that no matter how low prices may go nor how high they may reach, the real problem is, Can we produce enough for ourselves and enough more to make up the deficiency of our allies?

We can if we so desire. Autocracy believes we can not do it; believes that as members of a democracy we are too selfishly individualistic to desire it, too weak to accomplish it even if we did wish it. It admits our fighting ability but derides our power of self-control and self-sacrifice. Apart then from our obligation to the allies, it is incumbent on America to prove that democracy needs no tyrant's rod to govern

its ways or its appetites. We have already undertaken broad measures to increase our production of food, and our intelligence, our sense of value, of the object to be accomplished will inspire us to decrease our consumption. We shall be saving for victory.

In a sense the United States is taking part in a great cooperative experiment. It has entered the family of nations. It has assumed tremendous responsibilities. Its allies are dependent on it and expect high performance from it. Yet unless we practice among ourselves what are no more than a few minor deprivations, western civilization can not go on. It may be reiterated once more that the necessity for these economics is actually independent of any political or military events which may supervene in the immediate future. The world crisis compels them.

In conclusion let us again define the situation that confronts us, so we may realize how great is the task to which we have pledged our honor and our faith.

Take the basic food of the world—wheat. It seems probable that all that we now have plus what we can raise this year plus the Canadian crop will amount to about 1,000,000,000 bushels. We and Canada would ordinarily eat half of that. We need to save in addition seed for next year and a small safety margin. This brings our joint total needs up to 700,000,000 bushels, and leaves 300,000,000 for export. The imperative needs of our allies in addition to what they raise themselves are just twice that amount. The problem then is to meet the difference between the 600,000,000 bushels that they need and the 300,000,000 bushels that we have to send them.

Perhaps it will be more comprehensible if we drop the terms of bushels and express the problm in units,

assuming that every unit represents 10,000,000 bushels of wheat. On that basis we and Canada together have 100 units of wheat. We need 70 units for ourselves and so can spare 30 units. But our allies need 60 units of wheat. The problem then is to make the 30 units that we can spare fit their need for 60 units.

The only solution then lies in sharing the inescapable privations and sacrifices. We know that we have 30 units to spare, and it may be that by sacrifice and economy we can increase that to 45 units. Our allies need 60 units, but it may be that by sacrifice and economy they can get along on 45. The present prospects are that in any event 5 units of wheat will be sunk by the submarines, but that we must try to avoid. Our immediate duty is to save and send over-seas 450,000,000 bushels of wheat, when we have only two-thirds of that amount to spare. If each of us should eat three and one-half slices of bread for every five slices we each have been accustomed to, the desired result would be achieved, the victorious conclusion of the war would be assured, and tens of thousands of deaths from starvation would be avoided.

I. SAVE THE WHEAT

The Wheat Supply of the World

Despite the rigid measure adopted to reduce consumption among the allies, they will require to import next year larger amounts of cereals and meats than ever before. The large failure of the winter wheat harvest in France and England, larger consumption by armies in the field and munition workers, the reduced productivity of the land by reduction in man power, the sink-

ing of cargoes by submarines all pile up one increasing demand upon another, despite the efforts of the women in the fields. Moreover, the allies are more isolated to-day in their sources of food than ever before, even during the war. It requires three times the tonnage and double the danger to bring wheat from Australia and India than from the Atlantic seaboard, and to-day these sources are largely unavailable. The crop failure in the Argentine gives no hope from that quarter until next March or April, and the allies are, of course, isolated from the normal supply of Russia, Roumania, and Bulgaria. They are thus dependent upon North America for the vast majority of their food imports.

In a general way it may be stated that this country normally produces a surplus of most commodities, and that our problem is to secure the effective and economical distribution of these supplies; to induce as large an export surplus for the benefit of our allies as we can; to protect our own requirements; to ask the whole community to assist us in building up this surplus by every effort of economy that we can devise, and to set up such machinery as will furnish this balance wheel on prices.

At best the food of our allies will be a privation loaf, and every ounce we can add to it is a contribution to their strength and constancy in the war.

I think that it is recognized by all thinking men that the world war and the economic forces which have been set up have disorganized the ordinary balances and checks on prices. For instance, the price of wheat in normal times is a factor, not only of supply in the United States, but all the supplies in every country in the world.

The United States Must Conserve Wheat

1. By eliminating waste in the use of all breads and cereal products.

2. By eating more vegetables in place of other foods, especially during the summer months.

3. By substituting for wheat breads those breads which, whether made at home or by the baker, combine with wheat flour from 10 to 25 per cent of other cereal products or suitable flours or meals, as peanut flour, soy-bean flour, or with potato or sweet potato.

By using other cereals for bread making—for instance, rye, which will make a yeast-raised bread, and others, like corn, oatmeal, kaffir, and buckwheat, which can be used without flour to make "quick breads," such as corn pone, buckwheat shortcake, oat cake, and kaffir pone.

1. Eliminating Waste of Bread

1. Through the efforts of the food administration many wholesale bakers have agreed to stop taking back unsold bread from the retailers. This alone may save 5 per cent of the waste. We can not afford to sell stale bread for animal feed. The women of the country must cooperate with the retailers and order their bread 24 hours before it is to be delivered.

2. The bakers are agreeing to put on the market fewer kinds of breads, and these in smaller sizes, so that here again waste will be lessened.

3. All stale bread may be utilized through combining bread crumbs in the making of quick breads, yeast breads, scalloped vegetables, and similar dishes and desserts. Cutting the loaf on the table as needed also tends to lessen waste.

2. Conserving the Wheat through Increasing the Proportion of Vegetables in the Diet

We as a people are depending largely upon cereals for our energy supply. It is easily possible to use less cereal and make larger demands for energy on starchy vegetables. Our average consumption of potatoes per capita is about 9 ounces per day. If we could be induced to take an additional daily average of only 4 ounces of potatoes—that is, about one good-sized potato—our demand for bread would be reduced by about that amount per individual. Other heat-giving foods, such as sweet potatoes, bananas, corn, peas, and beans, may be used to reduce the demand upon cereals. On such a basis we may advocate decreased bread consumption.

3. Conserving One-fourth Our Wheat through Using Liberty Breads

For those of us who, through force of habit, demand bread three times a day, what is known as liberty bread may be used much more liberally in place of the wheat-flour loaf. These liberty breads are made by using the entire wheat ground into flour or substituting other cereals for part of the wheat flour. Corn is the native American cereal upon which we can rely for bread. Alone or mixed with flour it can be used in very many ways as a foodstuff. It is no new thing to us, and in depending upon it at this time we are only going back to earlier customs which have survived in the South more than in the North. It is sometimes said that too much corn is unwholesome, but this is not true. Pellagra, the disease once attributed to it, is not due to corn, but to another cause. For centuries barley and rye have been staple breadstuffs. It is within recent years

that barley has dropped out of the diet of Americans so largely as a breadstuff, though retained in some special forms, particularly in infant feeding. Returned to its former place, it will take the place of thousands of bushels of wheat and will produce a bread delicious in both flavor and texture. If we are willing to substitute for wheat flour from 20 to 35 per cent of other cereals, we can easily free the wheat needed for shipment to the allies.

Food Value and Importance of Bread in the Dietary

In the United States wheat bread is universally used and has become the chief means of giving the needed energy in the diet. Its tissue-building power is below that of most animal foods, dried peas, and beans and is unsatisfactory unless supplemented by other food products. Our safety in its use lies in the fact that we have always combined it in the diet with other foods—meat, peas, beans, or animal soups rich in gelatin. We measure its value primarily by the energy which it yields rather than by its power to supply protein, ash, and growth-regulating substances needed to build or repair body tissue, though even in this respect it is a valuable supplement to the materials on which we chiefly rely as tissue builders.

Comparative Food Value and Cost of Different Cereal Products

Estimates of the food values of the following common cereals are approximately equivalent. Patent flour, corn meal, rye, and rice yield about 1600 calories, and oatmeal 1800 calories, per pound.

Note.—It may be of local interest to secure from retailers in a town the price of the various cereals in 1913 as compared with the present price.

Use Local Cereal Products

A study should be made of the available local supply for the State or section of the country, using those cereals which are grown and ground in the immediate locality. Corn meal and rolled oats are available in almost every section of the United States. Barley and rye are less generally grown and sold in the retail markets. Rice may be used in so many other ways that its use in bread making is a minor factor. There promises to be a large yield of buckwheat which may be used in conserving our wheat supply. What we need to push is the use of barley flour, buckwheat flour, and rye flour. Kaffir and other grain sorghums are to be noted also, as they are of especial value in the sections in which they are grown. There is no difficulty in grinding and putting upon the market any of these products. It may not be wise at this time to advocate the selling of blended flours, as under the internal-revenue act it makes the work of the food commission arduous. Do your own blending in making homemade products.

Emergency Breads

Selection for Demonstration. Three from the following list of products:

Corn-meal griddle cakes, oatmeal muffins, and Indian pudding are suggested.

Introductory Statements. Make it a principle to increase the use of corn meal to the maximum. Pound for pound, the energy value of corn meal is equivalent to that of wheat flour. Every time corn meal is used where before we used wheat products, we are helping to win the war.

Have corn-meal mush for breakfast; add figs, dates, or other fruit, for variety; serve fried mush; use corn meal in quick breads, yeast breads, desserts. The breads are light, palatable, and capable of frequent use in the weekly dietary. Likewise, make the maximum use of oatmeal or rolled oats. Omit all wheat breakfast cereals. Use oatmeal or rolled oats, and secure variety through adding fruit. Use rolled oats to conserve one-fourth the wheat in making muffins, rolls, and yeast-raised bread.

Proportions and Directions

All measurements are level, and flour is measured after sifting. Proportions are for Minnesota flour.

CORN-MEAL GRIDDLE CAKES OR WAFFLES, I

1 cup milk (8 oz.).
$\frac{3}{4}$ cup flour (3 oz.).
$\frac{3}{4}$ cup corn meal ($3\frac{3}{4}$ oz.).
2 teaspoons baking powder ($\frac{1}{4}$ oz.).
$\frac{1}{2}$ teaspoon salt ($\frac{1}{8}$ oz.).
1 egg (2 oz.).

Add beaten egg to milk and add to dry materials, well mixed.

CORN-MEAL GRIDDLE CAKES OR WAFFLES, II

1 cup sour milk (8 oz.).
$\frac{3}{4}$ cup flour (3 oz.).
$\frac{3}{4}$ cup corn meal ($3\frac{3}{4}$ oz.).
$\frac{1}{2}$ teaspoon soda ($\frac{1}{14}$ oz.).
1 teaspoon baking powder ($\frac{1}{8}$ oz.).
$\frac{1}{2}$ teaspoon salt ($\frac{1}{8}$ oz.).
1 egg (2 oz.).

CORN-MEAL MUFFINS, I

1 cup milk or water (8 oz.).
$1\frac{1}{3}$ cups flour ($5\frac{1}{3}$ oz.).
$\frac{2}{3}$ cup corn meal ($3\frac{1}{3}$ oz.).
1 to 2 tablespoons fat ($\frac{1}{2}$–1 oz.)
1 to 2 tablespoons sugar ($\frac{1}{2}$–1 oz.).
1 egg (2 oz.).
4 teaspoons baking powder ($\frac{1}{2}$ oz.).
$\frac{1}{2}$ teaspoon salt ($\frac{1}{8}$ oz.).

Method I: Mix milk, egg, and melted fat, and add dry ingredients, well mixed.

Method II: Scald corn meal with the hot milk; add egg, melted fat, and dry ingredients.

CORN-MEAL MUFFINS, II

1 cup sour milk (8 oz.).
$1\frac{1}{3}$ cups flour ($5\frac{1}{3}$ oz.).
$\frac{2}{3}$ cup corn meal ($3\frac{1}{3}$ oz.).
1 to 2 tablespoons fat ($\frac{1}{2}$–1 oz.).
1 to 2 tablespoons sugar ($\frac{1}{2}$–1 oz.).
1 egg (2 oz.).
$\frac{1}{2}$ teaspoon soda ($\frac{1}{14}$ oz.).
2 teaspoons baking powder ($\frac{1}{4}$ oz.).
$\frac{1}{2}$ teaspoon salt ($\frac{1}{8}$ oz.).

Combine as in corn-meal muffins I, method I.

INDIAN PUDDING

$\frac{3}{4}$ cup cornmeal ($3\frac{3}{4}$ oz.).
1 quart milk (32 oz.).
$1\frac{1}{2}$ teaspoons salt ($\frac{3}{8}$ oz.).
3 tablespoons sugar ($1\frac{1}{2}$ oz.),
or
$\frac{1}{3}$ cup molasses ($4\frac{1}{2}$ oz.).

Heat the milk. Sift in the corn meal as in making mush. Add salt and sugar. Turn into buttered baking dish, put dish in pan of water, and bake very slowly $2\frac{1}{2}$ to 3 hours. Serve with hard sauce, cream, or crushed fruit.

OATMEAL MUFFINS, I

$\frac{1}{2}$ cup milk (4 oz.).
1 cup cooked oatmeal or rolled oats.
1 egg (2 oz.).
2 tablespoons fat (1 oz.).
$1\frac{1}{2}$ cups flour (6 oz.).
2 tablespoons sugar (1 oz.).
$\frac{1}{2}$ teaspoon salt ($\frac{1}{8}$ oz.).
4 teaspoons baking powder ($\frac{1}{2}$ oz.).

Cook oatmeal, using one part oatmeal to two parts water. A larger proportion of water makes too soft and gummy muffins. Mix milk, oatmeal, egg, and melted fat. Add dry ingredients after sifting them together. Bake 25 to 30 minutes. This makes 10 to 12 muffins.

OATMEAL MUFFINS, II

$1\frac{1}{2}$ cups milk (12 oz.).
2 eggs (4 oz.).
2 tablespoons fat (1 oz.).
2 tablespoons sugar (1 oz.).
1 teaspoon salt ($\frac{1}{2}$ oz.).
2 cups rolled oats ($5\frac{1}{2}$ oz.).
1 cup flour (4 oz.).
4 teaspoons baking powder (1 oz.).

Pour milk over oats and let soak one-half hour. Add eggs and melted fat. Add to dry ingredients, which have been sifted together. Bake 25 to 30 minutes. This makes 10 to 12 muffins.

Corn-meal and Oatmeal Yeast Breads

Introductory Statements. Corn-meal yeast bread, satisfactory in texture and mild in flavor, can be made using 20 per cent by measure or 25 per cent by weight of total cereal as corn meal. The flavor of white corn meal is less distinctive and the bread made from it differs in color from that of the usual wheat loaf less than that made from the yellow meal. These breads may be made by combining dry corn meal with the flour, but the product is less satisfactory than that in which the meal is first cooked as for corn-meal mush. The manipulation is the same as for wheat bread, except that it is a little more difficult to knead into the mush the full amount of flour and the dough is somewhat softer and stickier. Baking should occur in a slower oven, and should continue over a longer period—at least an hour.

Oatmeal yeast bread is coarser than wheat bread and is not unlike graham bread in appearance. It has a sweet, nutty flavor, much liked by persons who care for whole wheat or dark breads. Some care is necessary in combining the rolled oats with the mixture. The most satisfactory method has been found to be that of pouring the hot liquid over the rolled oats, allowing the mixture to cool rather slowly (about half an hour). Longer soaking of the oats produces a somewhat moister bread. The manipulation is the same as for wheat bread. The dough is a bit softer. Baking requires about 45 minutes.

Proportions and Directions

All proportions are for one loaf. The amount of yeast provides for a very short process—$3\frac{1}{2}$ to 4 hours. One-half the yeast suggested will make bread in 5 hours.

One cake of dry yeast used as a starter should produce yeast for six loaves. In all cases the amount of liquid should be equal to that added with the compressed yeast in the recipe given.

CORN-MEAL YEAST BREAD (1 LOAF)

$1\frac{1}{4}$ cups milk and water, or water (10 oz.).
2 tablespoons sugar (1 oz.).
1 tablespoon fat ($\frac{1}{2}$ oz.).
2 teaspoons salt ($\frac{1}{2}$ oz.).
$\frac{2}{3}$ cup corn meal ($3\frac{1}{3}$ oz.).
$2\frac{1}{3}$ cups flour ($9\frac{1}{3}$ oz.).
$\frac{1}{2}$ cake compressed yeast ($\frac{1}{4}$ oz.).
$\frac{1}{4}$ cup warm water (2 oz.).

Add sugar, fat, and salt to liquid, and bring to boiling point. Add corn meal slowly, stirring constantly until all is added. Remove from fire, cool mixture, and add compressed yeast softened in $\frac{1}{4}$ cup warm water. Add $2\frac{1}{3}$ cups flour and knead. Let rise until about double its bulk, knead again, and put in the pan. When light, bake in a moderate oven for at least an hour.

In mixing the dough the flour and corn meal are to be used as separate ingredients, because the corn meal must be scalded or a grainy bread results. When the corn meal mixture is removed from the stove, the housewife will doubt her ability to add the amount of floor called for. The flour will work in, as required, but a stiffer, stickier dough than that to which she is accustomed will result.

OATMEAL YEAST BREAD (1 LOAF)

1 cup milk and water, or water (8 oz.).
1 teaspoon salt ($\frac{1}{4}$ oz.).
1 tablespoon fat ($\frac{1}{2}$ oz.).
2 tablespoons sugar (1 oz.).
1 cup rolled oats ($2\frac{3}{4}$ oz.).
$2\frac{1}{2}$ cups wheat flour (10 oz.).
$\frac{1}{2}$ cake compressed yeast ($\frac{1}{4}$ oz.)
$\frac{1}{4}$ cup warm water (2 oz.).

Scald liquid and pour it over the rolled oats, sugar, salt, and fat. Let stand until lukewarm (about half an hour). Add yeast softened in warm water. Add flour and knead. Let

rise until double its bulk. Knead again and place in pan. When light, bake in a moderate oven from 45 to 60 minutes.

Use Barley, Rye, Boiled Rice, and Boiled Potato in Bread Making

Cottonseed Flour—Demonstration of Barley, Rye, Rice, or Potato Flour Yeast Breads

Selection for Demonstration. Two of above breads, according to local and available products.

Barley Yeast Bread. Introductory statements: Bread may be made using wheat flour and barley flour in mixtures containing from 33⅓ to 50 per cent barley flour. The bread containing one-third barley flour is light, palatable, and of especially pleasant flavor. A larger percentage produces a heavier, darker bread of pronounced barley flavor. The manipulation for this bread is the same as for wheat bread. The conditions and time for baking are also the same. The loaf is smaller.

Proportions and directions:

BARLEY YEAST BREAD

1 cup milk and water, or water (8 oz.).	1⅙ cups barley flour (4 oz.).
1 tablespoon sugar (½ oz.).	2⅓ cups wheat flour (9⅓ oz.).
1 tablespoon fat (½ oz.).	½ cake compressed yeast (¼ oz.).
1 teaspoon salt (¼ oz.).	

Soften the yeast in part of the liquid. Combine ingredients. Mix into a dough. Knead and let rise to double original bulk. Knead again. Put in the pan, and when again double in bulk bake about 45 minutes.

Rye Yeast Bread. Introductory statements: Commercial rye breads are made of a mixture of wheat and rye flours, known in the trade as 50–50. Rye flour

has much less expansion than wheat flour; hence the loaves are smaller. The manipulation is the same throughout as for wheat bread.

Proportions and directions:

RYE YEAST BREAD

1 cup milk and water, or water (8 oz.).	$2\frac{1}{4}$ cups rye flour (7 oz.).
1 tablespoon fat ($\frac{1}{2}$ oz.).	$2\frac{1}{4}$ cups wheat flour (9 oz.).
2 tablespoons sugar (1 oz.).	$\frac{1}{2}$ cake compressed yeast ($\frac{1}{4}$ oz.)
1 teaspoon salt ($\frac{1}{4}$ oz.).	2 tablespoons water (1 oz.).

Combine ingredients. Mix into dough and knead. Let rise until double original bulk. Knead again. When again double bulk, bake about 45 minutes.

Rice Yeast Bread. Rice has many other uses, as in puddings, etc., and is much in demand among the allies. Therefore its use should not be stressed in connection with emergency breads.

Cooked rice, combined with wheat flour makes delicious muffins and yeast bread. There are many ways of cooking the rice. The basic principles may be stated as follows: First, cook the rice so as to conserve all mineral matter and other soluble products.

Method: After the rice is thoroughly washed it should be put in a thick iron kettle or stoneware baking dish, cold water added so that the water stands three-quarters of an inch to an inch clear above the rice. A heavy or weighted cover should be used to seal the dish. Cook slowly over direct heat or in the oven until all the water has been absorbed and the grains are soft and steam escapes from the vessel. This is the Japanese method. The second method, more frequently used in the United States, is to use a very large amount of boiling water to a small amount of

rice, the rice being added slowly enough not to stop the boiling. The water is boiled briskly 20 minutes, or until the kernels are tender. Then it is drained in a colander or strainer, set on the back of the stove, or put in a slightly warm oven or in a pan over hot water, to dry off a bit. There results a fluffy mass of large, plump grains, each perfectly distinct in itself, instead of the gummy mush so often served as boiled rice.

The rice yeast bread is very white in color, is moister than wheat bread, and keeps moist longer. It is handled in much the same manner as wheat bread. The first dough, however, is much stiffer, and after once rising the light dough is so soft that it can not be kneaded with the hands. It should be well stirred with a strong spoon and placed in the pans, looking much like a stiff drop batter. After baking, the upper crust is less smooth than that of our familiar wheat flour loaf.

Proportions and directions:

These amounts make two large or three small loaves ot bread.

RICE YEAST BREAD

$\frac{1}{2}$ cup milk and water, or water (4 oz.).
4 tablespoons sugar (2 oz.).
4 tablespoons fat (2 oz.).
$1\frac{1}{2}$ teaspoons salt ($\frac{3}{8}$ oz.).
7 cups boiled rice.
8 cups flour (32 oz.).
$\frac{1}{2}$ cake compressed yeast ($\frac{1}{4}$ oz.).
$\frac{1}{4}$ cup warm water (2 oz.).

Scald liquid if milk is used. Pour over fat, sugar, and salt. Cool and add yeast, moistened in $\frac{1}{4}$ cup warm water. Add rice and flour and knead. After second rising bake 45 minutes.

Potato Yeast Bread. Introductory statements: Boiled potatoes, mashed and combined with wheat flour may be used in making a bread of good flavor and texture.

The potato bread is slightly darker in color than patent flour bread and is also somewhat more moist. It is relished by persons who do nor care for any but so-called "white bread." Two manipulations are satisfactory. Either all the flour may be added in the first mixture, making a dough which is very stiff and difficult to knead or a part of the flour may be reserved and added with the second kneading. In either case the dough is soft at the second handling, but after baking it produces a satisfactory loaf.

Proportions and directions:

The following amounts make three loaves of bread.

POTATO YEAST BREAD

½ cup milk and water, or water (4 oz.).	4 cups boiled potatoes.
4 tablespoons sugar (2 oz.).	8 cups flour (32 ounces).
4 tablespoons fat (2 oz.).	½ cake compressed yeast (¼ oz.).
1½ teaspoons salt (⅜ oz.).	¼ cup warm water (2 oz.).

II. SAVE THE MEAT

World Supply of Meats

The world's available supply of meat is not sufficient to meet the needs of the United States and of our allies unless we practice economy, particularly in the consumption of those meats which are readily transported, namely, beef, mutton, and pork.

Any attempt to give exact figures which will state the world's supply of meat is hopeless, but a few figures may indicate the condition in the United States January 1, 1917. At that time we had 63,617,000 cattle, 67,453,000 swine, and 48,483,000 sheep. This includes all dairy stock, which must be saved to meet the increasing demand for milk and milk products.

The figures for France, England, and Italy are all of them at least a year old, and therefore can not be given as representing present conditions. France has attempted to save her dairy cattle. The sale of meat has been restricted by legislation. The horses killed at the front are shipped directly to Paris for sale in the public markets. Even this additional supply has not met the demand, so that the sale of meat is not only restricted in amount to individuals but is also restricted to certain days in the week. England, because of lack of cattle feed due to the increased acreage devoted to raising field crops for human consumption, is reducing her total livestock through increased slaughter for human use. Her food regulations, issued in May of this year, therefore show a definite increase in the amount of meat that may be purchased per individual. This condition must necessarily be temporary, and England will be again reduced to a very restricted meat requirement. France and Italy have long used meat economically, depending upon the use of small amounts of meat to make the vegetable products savory, either in the form of soups or stews or pastries.

General Habit of Meat Consumption in the United States

When the British commission was sent over from England in 1909 to study the living conditions of the American workmen as contrasted with the conditions of the English workmen, they published a voluminous report as the result of the study in all sections of the East, Middle West, and South. These studies showed conclusively that the diet of the American people was

very much better than the diet of the English workmen, but the striking point was our lavish use of our meat supply. This, in spite of the fact that the lessening of the free pasture land and the increased cost of feed grains had brought about a condition of lessened meat production relative to the population of the country. Careful summaries show that the present daily consumption of beef is $3\frac{6}{10}$ ounces per capita, and of pork $4\frac{5}{10}$ ounces per capita.[1] The suggestion that is being made is that we as a people reduce this total consumption 1 ounce per day, and if possible an additional ounce be replaced by the use of all kinds of fish, preferably a local supply; by increased use of whole cream cheese and a local use of poultry and eggs, where the prices are not prohibitive. If the suggestion of doubling the quantity of vegetables used is followed, the diet will be improved in variety without lowering its nutritive value.

Need of Tissue Building in the Diet

The need of tissue-building material in the diet is so well understood that the only discussion necessary here is in connection with the amount of protein and the character of the protein in the foods available for man. All proteins are made up of complex nitrogen products, which are often called "building stones."

Some proteins contain these "building stones" in proper proportion for the building of new tissue. Others lack some of the essential "building stones." The foods containing the first type are called complete or efficient tissue-building foods. The others are known as incomplete or inefficient tissue-building foods. The value of meats in the diet lies in the fact

[1] This includes refuse or meat as purchased.

that they belong to the complete type of protein foods, and therefore when used liberally in the diet the necessity for intelligent choice is eliminated. The list of perfect or efficient proteins includes beef, veal, mutton, lamb, pork, poultry, game, fish, cheese, milk, and eggs. The inefficient proteins, those which need supplementing with more or less from those of the first group are soy bean, peanuts, navy beans, wax beans, kidney beans, lima beans, dried peas, lentils, nuts, corn, wheat, oats, barley, rye, buckwheat, gelatin.

For the young child, the youth and anyone recovering from a wasting disease there must be combinations of protein foods which will give the right combination of "building stones." As has been stated, for the young child milk stands first on the list. For the adult the need for large amounts of the more nearly perfect proteins is not apparent. Their diet can be more easily restricted to a limited use of the first list and a liberal use of the second.

Adequate Combinations of Protein Foods

In any discussion of exchange values in this class of foods the relative digestibility of the proteins is an important factor. The proteins in the first list are, as a rule, quite completely and easily digested. The proteins of the second group are not so easily or completely digested. They contain a great deal of what is called "roughage," which while it has the advantage of aiding in the quicker elimination of waste material from the alimentary canal, has the disadvantage of not permitting the protein to be so completely absorbed. In some cases bacterial action in the alimentary canal may be increased with this type of food, hence in-

dividual peculiarities may prevent their more liberal use. As a general rule, the proper combinations of these foods may be given as follows:

Cereals do not help each other out because their "building stones" do not supplement each other.

Legumes (peas, peanuts, and beans) do not help each other for the very same reason.

Most legumes, combined with cereals, make a more nearly efficient protein combination.

Gelatin supplements the lack of some of the "building stones" in most of the cereals, but it does not help out the lack in the legumes.

The combination of any of these with milk or cheese or meat or eggs is efficient.

Safe Standard to Follow

The diet of the American people should be so selected that the average for men, women, and children is at least 70 grams (about 2½ ounces) of protein a day. One-fourth to one-third of this may come from cereal foods, one-seventh may come from milk and its products, one-seventh to two-sevenths from animal proteins, the remainder to be secured from a wise combination of vegetables and fruit. The detail of this is a study by itself.

Working Program

Because of the difficulty of securing adequate transportation facilities, it is wise to use very largely the local supply of animal foods, discouraging as much as possible the killing of young animals, as veal and lamb. Poultry and eggs, game in season, and all varieties of fish should be used, but next to maintaining our regular

bread supply, the most important factor is to increase the use of milk in so far as our supply will admit. The present supply seems to indicate per capita allowance of about $\frac{1}{3}$ quart a day. In case of lack of adequate amount for the family, it is wiser to limit the use of the milk to direct consumption by children and to the use in the preparation of foods for the table. The utilization of the protein from the cereals in the feeding of the dairy cow shows that we recover more of the proteins in milk than we would if it were used to produce muscle.

1. For example, we recover from 35 to 50 per cent of the protein in the feed when it comes to us in the form of milk, but only from 10 to 20 per cent in the form of beef proteins. In other words, we get 300 per cent more return on the investment through the consumption of milk. For this reason every ounce of the available milk supply should be used as food, either in the form of milk itself, whole or skim, or in the form of whole-milk cheese or cottage cheese and butter.

2. Vegetable food, as peas, beans, peanuts, lentils, cereals, as oats, rye, barley, and any local supply of nuts may be used to supplement a milk, fish, or egg diet.

3. No meat should be wasted. All left-over meats may be used as a source of flavor as follows: In vegetable soups, stews, goulashes, gravies, pies, creamed meats, cereal pilafs, chowders, casserole dishes, and with green vegetables.

4. Fresh fish may be used in the same way that meats are used, and with proper choice of flavoring material, are often preferred to the meat dishes.

5. Cheese may be used as a supplement to all of the group of protein foods that are listed under incom-

plete proteins. The soup kitchens of the Germans may teach us many lessons on how to extend the use of meat as flavor.

III. SAVE THE SUGAR

In common parlance sugar refers to the "cane sugar" obtained from sugar cane or beet root, but the chemist distinguishes between various kinds. The latter vary more in flavor than in final digestibility and food value. The use of sugar (present in fruits, vegetables, etc.) in the United States has been on an average practically 4 ounces per day per capita. While not all of us use 4 ounces of sugar daily, many of us will be found to use that amount and even more if we include all forms of sweets, i.e., not only the sugar eaten on fruits and cereals, or in tea, coffee, etc., but also that used in general cooking, and in cakes, desserts, preserves, candies, "soft drinks," etc. The fact that there is now a limited supply to meet all demands for sugar will require us to reduce our consumption. From present indications it would seem that if we could reduce it to an average of 3 ounces daily we would meet the situation. The experience in Europe seems to indicate that the use of sugar is largely for the psychological effect of the sweet flavor, which helps make palatable the less highly flavored foods such as cereals. It has been used in the armies in the form of jams. Ian Hay tells some amusing stories of English "Tommies" who would face any danger cheerfully, but broke into open rebellion when deprived of their strawberry marmalade.

Americans have come to consider a generous amount of sugar as a necessity of life, but on analysis we find

that its use can be defended only on the psychological ground of the palatability its flavor lends to the diet, and (under special conditions of muscular exertion) on the ground that its energy becomes available to the body more rapidly than that of the other nutrients.

On the other hand, the excessive use of sugar is not only economically extravagant but may cause digestive disturbances. The amount which one can eat with impunity depends on the muscular activity, the amount of other foods in the diet, and, in case large quantities of sugar are consumed, on the tolerance of the individual for it. Persons of great muscular activity, like athletes, soldiers on exhausting marches, or the never-quiet schoolboy, require more energy-yielding food than less active persons of the same size and weight, and their craving for sweets may be legitimate. Under-nourished children of the city poor, who spend their pennies for candies, may obtain in this way a desirable supplement to their inadequate meals. But where the meals are adequate or even excessive, eating sweets in addition overtaxes the digestive organs, tends to corpulency, and spoils the appetite for less highly flavored but equally nutritious food. The latter consideration is of especial importance with children, whose appetite for sweets is much stronger than that of adults and than their own appetite for the more essential tissue-building foods.

Working Program

As a working program on reducing the present use of sugar the following may be recommended:

1. Train the family to use little or no sugar on the breakfast cereals or replace by fruits eaten with the cereal or dried fruits, raisins, dates, etc., cooked with

it. Most palates crave less sugar on these foods if the latter are well cooked and carefully salted.

2. Reduce the use of soft drinks, lemonade, etc., in the making of which sugar is used very liberally.

3. In preparing the food for the family give preference to recipes which call for less sugar, and if possible omit it from yeast bread; reduce the use of candies and cakes, especially kinds in which large quantities of sugar are used. Especially discourage the eating of candy between abundant meals.

4. Use sirups, as corn sirup, apple sirup, and other fruit sirups, molasses and sorghum sirups, and honey wherever it is possible to utilize these products in the place of ordinary sugar. Remember that a good sirup can be made on the farm from apple "culls" and used as a table sirup or in cooking.

5. Use more fruits, both fresh and dried, to give the desired sweet flavor to the diet.

IV. SAVE THE FAT

It has been estimated that on the average over 3¼ ounces (about 96 grams) of fat purchased as such—that is, butter and other table fats, cooking fats and cooking and table oils—are included in the food provided for each person in the United States. This could be cut down to a little over 2 ounces (60 grams) without danger to health, provided the kinds of fat used were carefully chosen and all the fat from meat trimmings and meat cookery were used to advantage. At present fats are chosen more for pleasant flavor and culinary convenience than with reference to their distinctive nutritive value. The waste from this class of foods is large. City garbage has been found to yield from

35 to 40 pounds of fat per ton, all coming from homes, hotels, and restaurants.

If fat were needed only for the production of energy in the body, it would be a relatively simple matter to cut down on our use of lard, butter, table oils, and other separated fats, and depend more on cereals, potatoes, and other starchy foods. Recent discoveries regarding the substances which regulate the growth and repair of body tissue, however, have shown that such a course would not be safe. Associated with fat in certain food materials, especially in the fat of milk and eggs, such meat fats as suet, and the small amounts of fat found in the green leaves of potherbs and salad plants are minute quantities of recently discovered and as yet unnamed substances most important in nutrition. These are sometimes referred to as "growth determinants." When these are lacking, even in an otherwise adequate diet, growth of new tissue and repair of old does not take place as it normally should. We do not yet know exactly how much of these substances is found in different kinds of fats, or how much is needed by children or adults, but it is now impossible to consider the question of fat in the diet without considering them.

Conditions in the warring nations of Europe where the fat ration has been cut to the lowest limit have shown that such a practice hinders the normal growth of children, the maintenance of health in adults, and the repair of body tissue after wounds.

The list of foods in which these "growth determinants" are chiefly found includes egg yolk, butter, cream, rich milk, cream cheese, and the leaves of most of the growing plants that are used for greens or salad. Lower in the list will come the table butter substitutes

—suet, beef drippings, and possibly goose and chicken fats. It is possible that the other animal fats and most, if not all, of the vegetable oils lack this "growth determinant."

V. METHODS OF ELIMINATING WASTE

(*a*) Eliminate waste by utilizing all fat left from meats. This is probably the most important household method of reducing the consumption of fat. A great many women do not realize that the trimmings from beef, pork, mutton, and fowl can be rendered and used in cookery instead of fats specially purchased for that purpose. Directions for preparing and using them will be found in any good cookbook.

In some households the amount of fats which accumulates from the meats served is larger than can be used for cooking; in such cases it should be used for making soap, or it should be given away or sold to some one who will use it. Better still, its accumulation should be avoided by choosing and using meats more carefully.

If the fat from meat trimmings or tried out in cookery is available, use it with rational economy when fat must be purchased for cookery.

As far as possible avoid cooking by means of frying and sautéing. If these methods are followed, use rendered fats such as those referred to, not fats specially purchased for the purpose.

(*b*) Households in which cream is now freely used may with care reduce the amount consumed without greatly lessening attractiveness of the meals. "Top milk" may be used in tea and coffee and on cereals, baked apples, etc. Unless the meal is otherwise lacking in fat, cream desserts should be sparingly used.

Substituting water ices made with fresh fruits for ice cream not only saves fat but utilizes "perishables."

(*c*) We may save table butter by serving smaller portions; not because we should attempt to decrease materially the use of butter on the table, but because so often the portion served is larger than is needed or even desired. Although that which is left on the butter plates might be utilized for cooking, cheaper fats should be used for that purpose.

The recommendation of the food administration is to eliminate the use of butter in cookery in order to make the supply go around so that we may have butter for table use. While all of us may not agree to this, still the more nearly we fulfill that request the more nearly will we meet the vital needs of our own people and the Army at the front.

(*d*) Children should be trained and adults encouraged to eat all the fat served with meat. This prevents waste and lessons the amount of separated fat needed in the daily food.

In all of these recommendations we must remember the psychology of the individual is the most potent factor with which we have to deal. If the issue is pushed too hard or without great tact, we may defeat our own purpose to save a small portion of our food supply for those who are battling to maintain the object for which our nation was created—liberty and democracy.

U. S. DEPARTMENT OF AGRICULTURE
FARMERS' BULLETIN NO. 808

WHAT THE BODY NEEDS[1]

By

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Contribution from the States Relations Service
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INTRODUCTION

How can the housekeeper tell whether or not she is providing the food which her family needs and is getting the best possible returns for the money she spends? Unfortunately, the price she pays for food is no test of the nourishment it yields to the body. Tomatoes at 5 or 10 cents apiece in winter do not build body tissues nor furnish fuel for the body engine any better than those at 5 cents a quart in summer, nor does fancy capon at 40 cents a pound nourish the healthy body

[1]Prepared under the direction of C. F. Langworthy, Chief, Office of Home Economics.

Note.—This bulletin gives a simple method of selecting and combining food materials to provide an adequate, attractive, and economical diet.

more generously than fowl at half the price. Appetite is not always a safe guide. A child's appetite might be satisfied with a diet of nothing but sugar, but this certainly would not be good for him. Neither can hunger and its satisfaction always be relied on. A bulky diet of potatoes or bananas alone would soon make a person feel that he had eaten enough, but would not furnish all that the body needs.

Evidently what a person who plans meals ought to know is what things the body needs in its food and how these needs can be filled by the ordinary food materials. This paper is intended to give such information in a simple way. It should make plain that different kinds or classes of foods serve different uses in the body and should help the housekeeper to choose those which will serve all these uses without waste.

The Day's Food

A man who does fairly hard muscular work would be likely to get the food which his body needs if supplied daily with such a combination of foods as the following:

1½ pounds of bread, having about the same food value as 1 pound of such cereal preparations as wheat or rye flour, oatmeal, corn meal, rice, etc.

2 ounces, or ¼ cup, of butter, oil, meat drippings, or other fat.

2 ounces, or ¼ cup, of sugar; or ⅓ cup of honey, or sirup, or an equivalent amount of other sweet.

1¼ pounds of food from the following: Fresh fruits and green or root vegetables.

12 ounces of food from a class which may be called "meats and meat substitutes"; that is, moderately fat meats, poultry, fish, eggs, cheese, dried legumes (beans, peas, lentils, cowpeas, and peanuts). Milk also belongs among these foods, but because of the large amount of water it contains half a glass, or 4 ounces, of it would be required to equal an ounce of any one of the others.

A man who works hard out of doors all day probably would need more food than this, and one who sits all day at his desk would need less. The amounts given are suitable for a man who, like a salesman in a store, walks about more or less and does more or less of such work as lifting.

A family consisting of a man and a woman who do moderately hard muscular work and three children—say, between 3 and 12 years of age—would get the food they require if supplied daily with:

$4\frac{1}{2}$ pounds of bread, having the same food value as 3 pounds of wheat or rye flour, oatmeal, corn meal or hominy, or rice; or about $2\frac{3}{4}$ pounds of cereals and 5 or 6 medium-sized potatoes.

$\frac{3}{4}$ cup of fat (butter or butter with oil, beef drippings, or other fat)—a weekly allowance of $2\frac{1}{2}$ to 3 pounds.

A little more than 1 cup of sugar, or a weekly allowance of 4 pounds; or an equivalent amount of some other sweet.

4 pounds in all of fresh fruits and fresh or root vegetables.

One of the two following, the choice depending on the age of the children:

3 quarts of milk and 1 pound of other foods taken from the meat and meat-substitute group.

2 quarts of milk and $1\frac{1}{2}$ pounds of other foods taken from the meat and meat-substitute group.

This rather rough calculation is based on the assumption that cereals contain, on the average, about 12 per cent protein, 1 per cent fat, and 75 per cent carbohydrates, and that 1 pound of bread contains about $\frac{2}{3}$ of a pound of cereal; that butter, oil, lard, and other fatty foods average 90 per cent fat; that fresh fruits and fresh and root vegetables average about $\frac{1}{2}$ per cent protein and 10 per cent carbohydrates, with negligible quantities of fat; and that meats, fish, eggs, cheese, etc., as purchased, may be considered to average about 14 per cent each of protein and fat.

The estimate also assumes that all the fat obtained with the meats, etc., is utilized, being either eaten with the meat or saved for use in cookery. Under these conditions the fuel value of the diet would be about 10,000 calories per family per day, or the equivalent amount of 3,000 calories per man per day; the protein value would be about 330 grams per family, or 100 grams per man per day.

The cereals in such a ration would include $1\frac{1}{2}$ pounds of bread, one ordinary-sized portion of rolled oats (one-fourth pound in all), and one of rice for each person (one-half pound in all), and a pound of flour for use in cooking. The meat and meat-substitute group would include 2 quarts of milk, 1 pound of beef, and two eggs.

In such combinations of food materials bread and other preparations of cereals are used as freely as they can be without making the ration one sided or unattractive. Such cereal foods form a very wholesome and economical basis for the diet, whether the cereal is used as a breakfast dish, as flour or meal in bread and cakes, or in other ways. A diet equally nourishing and wholesome might be planned with less cereal, but this would make it necessary to increase the amount of the more costly foods, such as meat, fruits, vegetables, and sweets. When cereals are used as largely as in the diet just described it is most important that they be made as attractive as possible. This means good bread, well-cooked and carefully salted breakfast cereals, and inexpensive but well-made and seasoned cakes and puddings. Rice, macaroni, and hominy can often be made more appetizing and nutritious by combining with them small amounts of materials which are not so cheap and have more

distinctive flavors. Among these are meat and cheese, and onion, tomato, and other seasoning vegetables. Examples of such combinations are rice and meat, meat pie, or meat with dumplings; macaroni and cheese; tomatoes cooked with bread crumbs or rice; and cereal and fruit puddings, or cereal and milk puddings.

The following meals are given, not because they are recommended above many others that might be used, but simply to show that such foods can be combined into dishes such as are commonly used in American homes.

SAMPLE MEALS FOR A FAMILY

(Man, woman, and three small children)

BREAKFAST

Fruit, 1¼ pounds of fresh fruit (equivalent to 3 medium-sized oranges, 5 small apples, or a quart-box of strawberries), or 3 or 4 ounces of dried fruits (equivalent to 10 or 12 dates or 4 or 5 figs).

Cereal breakfast food, 4 ounces before being cooked, or about 1½ pints after it is cooked. The equivalent in food value in puffed or flaked, ready-to-eat cereals would be 5 or 6 cups.

Milk on cereal, ¼ cup for each person.

Sugar on fruit, on cereal, or in coffee, 2½ level tablespoons or 1¼ ounces.

Bread, 8 slices, or 8 ounces.

Butter, 1¼ ounces, or 2½ cubic inches.

An egg or 2 ounces of meat, fish, or poultry for each older person and a glass of milk for each young child.

DINNER

Meat, or fish, ¼ pound per grown person; or, for each child, an egg or a glass of milk.

Potatoes (5 medium sized), 1¼ pounds.

Another vegetable (turnips, spinach, corn, cauliflower, or other), 1 pound.

Bread, 8 slices, or 8 ounces.
Butter, $1\frac{1}{4}$ ounces, or $2\frac{1}{2}$ cubic inches.
Steamed apple (or other fruit) pudding. (Ingredients: Two cups flour, 2 tablespoons butter, $\frac{3}{4}$ cup milk, 4 apples, 1 tablespoon sugar.)
Sauce. (Ingredients: One-half cup sugar, $1\frac{1}{2}$ tablespoons flour, 2 teaspoons butter, $\frac{1}{4}$ cup water, flavoring.)

SUPPER

A gravy made out of 1 pint of skim milk, $\frac{1}{4}$ cup flour, 2 level teaspoons butter, and 4 ounces salt or smoked fish (just enough for flavor). To this can be added the egg yolk left from the frosting of the cake. (See below.)
Rice, 8 ounces, or 1 cup, measured before being cooked.
Bread, 8 slices, or 8 ounces.
Butter, $1\frac{1}{4}$ ounces, or $2\frac{1}{2}$ cubic inches.
One-half of a cake. (Ingredients for whole cake: One-fourth cup butter, $\frac{1}{2}$ cup sugar, 1 egg, $\frac{1}{2}$ cup milk, $1\frac{1}{2}$ cups flour, $2\frac{1}{2}$ teaspoons baking powder.)
Frosting made with 1 egg white and $\frac{1}{4}$ cup sugar.

What the Day's Food Should Provide

The above meals would supply the following substances in about the right proportions to keep the family in healthful condition and to make the food taste good, providing they were well prepared.

A. *Mineral substances* of great variety (lime salts, compounds of phosphorus, iron, and others).—These are used by the body for building material and are found in all parts of it. They also produce substances within the body tissues which tend to offset acid substances produced in the tissues in the course of digestion of meats and cereals and serve many other important uses. Without fruits and vegetables the meals would be likely to lack certain mineral substances. Without milk they would be lacking in a mineral substance specially needed by children; that is, lime.

B. *Protein.*—Protein serves as fuel for the body and also provides a certain important element, nitrogen, which is needed in the case of children for growth and in the case of both children and grown people to keep the body in repair. Without the meat or meat substitutes (including milk) the meals would be lacking in this body-building material.

C. *Starch.*—This is one of the chief fuels of the body and is supplied mainly by the cereal foods.

D. *Sugar.*—This serves as fuel for the body and to flavor the food. It is found in milk, fresh fruits and many other materials but unless small amounts of very sweet materials—sugar itself, sirup, or honey—are used, the diet is likely to be lacking in it.

E. *Fat.*—This serves as body fuel and also improves the flavor and texture of the food. It is present in meats, nuts, and many other foods, but unless small amounts of specially fat materials, like butter, oil, or cream, are used, the meals are likely to be lacking in it. Moreover, dishes cooked without a certain amount of fat and meals served without butter or some substitute seem, to most persons, dry and unpalatable.

F. *Cellulose.*—This is the material which makes up the framework of plants. It gives bulk to the diet and may tend to prevent constipation. Without the fruits and vegetables the meals would be lacking in this important element.

G. *Certain newly discovered substances in very small amounts*, which are believed to play an important part in keeping people well and in promoting the growth of children. Without milk in the diet some of these substances, particularly those necessary for children, would be lacking, and without meat, milk, eggs, fruits,

and vegetables others needed by persons of all ages might not be present in sufficient amounts.

H. *Flavorings and condiments.*—In most families some materials are used in preparing or serving food which add to the attractiveness of the meals without furnishing the body any nourishment. Among these are salt, pepper, vinegar, lemon juice, spices, seasoning herbs, horse-radish, flavoring extracts, and many other materials often spoken of as "condiments." These are not discussed at length, because they are not absolutely needed by the body. They may, however, be very useful in making an otherwise unattractive diet taste good. In fact, the secret of making inexpensive meals attractive lies largely in the skillful use of seasoning and flavors, and in this way may well be worth the cost they add to the diet even if they do not increase its actual food value.

Any kind of food contains one or more of the substances just described, and they are combined in as many different ways as there are kinds of food. A satisfactory diet contains all of them and each in its proper proportion, and the problem of planning meals is really that of choosing foods which will do this.

Grouping Foods to Show Their Uses

Perhaps as easy a way as any to select the right foods is to group the different kinds according to their uses in the body and then to make sure that all the groups are represented regularly in the meals. Fortunately no more than five groups need be considered: (1) Fruits and vegetables; (2) meats and other protein-rich foods; (3) cereals and other starchy foods; (4) sweets; and (5) fatty foods. The materials under

each of these heads have their special uses. It will be helpful, therefore, for the housekeeper to form the habit of thinking of the many different kinds of food which she handles as grouped in some such way as the following:

Group 1.—Fruits and vegetables, such as apples, bananas, berries, citrus fruits, spinach and other greens, turnips, tomatoes, melons, cabbage, green beans, green peas, green corn, and many other vegetables and fruits. Without these the food would be lacking in mineral substances needed for building the body and keeping it in good working condition; in acids which give flavor, prevent constipation, and serve other useful purposes; and in minute quantities of other substances needed for health. By giving bulk to the diet they make it more satisfying to the appetite.

Group 2.—Meat and meat substitutes, or protein-rich foods: Moderately fat meats, milk, poultry, fish, cheese, eggs, dried legumes (beans, peas, lentils, cowpeas, peanuts), and some of the nuts. These are sources of an important body-building material, protein. In the case of children part of the protein food should always be whole milk.

Group 3.—Foods rich in starch: Cereals (wheat, rice, rye, barley, oats, and corn) and potatoes (white and sweet). Cereals come near to being complete foods, and in most diets they supply more of the nourishment than any other kind of food. It is not safe, however, to live only on cereals. The grains may be simply cleaned and partially husked before cooking, as in cracked wheat and Scotch oatmeal; they may be ground into flour and used as the basis of breads, cakes, pastry, etc.; or they may be partially cooked at the factory, as in many breakfast preparations; or

they may be prepared in the form of such pastes as macaroni, noodles, etc. In all these forms they furnish the body with the same general materials, though in different proportions.

Group 4.—Sugar (granulated, pulverized, brown, and maple), honey, molasses, sirup, and other sweets. Unless some of the fuel is in this form the diet is likely to be lacking in flavor.

Group 5.—Foods very rich in fat: Bacon, salt pork, butter, oil, suet, lard, cream, etc. These are important sources of body fuel. Without a little of them the food would not be rich enough to taste good.

Some food materials really belong in more than one group. Cereals, for example, supply protein as well as starch; potatoes supply starch as well as the mineral matters, acids, cellulose, and body-regulating substances, for which they are especially valuable; and most meat supplies fat as well as protein. For the sake of simplicity, however, each material is here grouped according to the nutrient for which it is usually considered most valuable. These points are all brought out in more detail in other bulletins which discuss the special groups.

The lists given below show some of the common food materials arranged in these five groups. If the housekeeper will consult them in planning meals until she has learned where each kind of food belongs, she will have taken the first step toward providing a diet which will supply all the food needs of her family. It will be only one step, to be sure, but it should prevent two mistakes—that of serving meals that have not sufficient variety, and that of cutting down in the wrong places when economy either of time or money is needed:

Group 1.—*Foods depended on for mineral matters, vegetable acids, and body-regulating substances*

Fruits:	Vegetables:
Apples, pears, etc.	Salads—lettuce, celery, etc.
Bananas.	Potherbs or "greens."
Berries.	Potatoes and root vegetables.
Melons.	Green peas, beans, etc.
Oranges, lemons, etc.	Tomatoes, squash, etc.

Group 2.—*Foods depended on for protein.*

Milk, skim milk, cheese, etc.	Fish.
Eggs.	Dried peas, beans, cowpeas, etc.
Meat.	Nuts.
Poultry.	

Group 3.—*Foods depended on for starch.*

Cereal grains, meals, flours, etc.	Cakes, cookies, starchy puddings, etc.
Cereal breakfast foods	Potatoes and other starchy vegetables.
Bread.	
Crackers.	
Macaroni and other pastes.	

Group 4.—*Foods depended on for sugar.*

Sugar.	Candies.
Molasses.	Fruits preserved in sugar, jellies, and dried fruits.
Sirups.	Sweet cakes and desserts.
Honey.	

Group 5.—*Foods depended on for fat.*

Butter and cream.	Salt pork and bacon.
Lard, suet, and other cooking fats.	Table and salad oils.

Thinking of foods according to the group to which they belong or according to the nutrient which they supply in largest amount will help the housekeeper to see whether in the meals she plans she has supplied all the different materials needed, especially whether

there is the necessary, though small, amount of tissue-building mineral matters and body-regulating materials (group 1), and of tissue-building protein (group 2). When she has made sure that these are present, she may safely build up the bulk of the diet from whatever materials from the other groups seem economical, wholesome, and appetizing. By means of this grouping she will be reminded that meals consisting only of cereal mush (group 3) served with butter (group 5) and sirup (group 4) would not be a complete ration and would almost surely be lacking in body-building material, because there are no foods from either group 1 (fruits and vegetables) or group 2 (protein rich). It will become clear, also, that a school lunch of a kind far too frequently served, consisting of bread and cake, is lacking in the same way, and that a glass of milk (group 2) and an apple or an orange (group 1) would make it far more nearly complete. She will learn the wisdom of serving fruit (group 1) rather than a whipped-cream dessert (group 5) or a suet pudding (groups 3 and 5) after a course including a generous portion of fat meat (groups 2 and 5).

The grouping will also help the housekeeper who wishes to save money or time to simplify her meals without making them one-sided or incomplete. For example, if she has been serving bread, potatoes, and rice or hominy in one meal, she will see that one or even two of them may be left out without omitting any important nutrient, providing a reasonable quantity of the one or two remaining is eaten. It will show her that a custard which is made of milk and eggs, two foods from group 2, would hardly be needed after a meal in which a liberal supply of meat had been served, provided one ate heartily of all, and that a child does

not need milk at the same meal with an egg or meat. It will suggest that baked beans or other legumes, or thick soups made of legumes, are substitutes for meat rather than foods to be eaten with meat.

This method of planning prevents substituting one food for another which has an entirely different use. It prevents the housekeeper, for example, from trying to give a pleasant variety by using an extra amount of cakes or sweet desserts in the place of fruit and vegetables when the latter seem difficult to obtain. Sugar is nutritious and has a valuable place in the diet, but the nourishment it furnishes is fuel and not the body-building and body-regulating materials which are found in fruits and vegetables, and it is not safe to cut them out, even if the meals can be made attractive without them. Fortunately, they are not always so hard to obtain as it seems, and the wise housekeeper will make every effort to supply them. In general, economy within each group is safer then using an inexpensive food from one group in place of an expensive one from another group.

Thinking in terms of these groups will also help when laying in supplies. Dried peas and beans and dried fish, canned fish, and meat, and some kinds of cheese keep for a long time and can be used in place of fresh meat in an emergency. Fruits and vegetables put up when they are abundant will help to supply this important group in winter.

Farm women can look even farther ahead, and often can plan to raise a variety of foods for use when it is difficult to buy at reasonable prices; for example, enough beans to give the family a generous supply. Though navy beans have been most largely used in this country, there are many other good and easily

grown kinds that can be chosen to give variety. In the south cowpeas should be not overlooked. If sugar is high in price honey can be produced, and home-made or purchased sorghum, maple, or cane sirup can be used.

How to Tell Whether or Not the Diet is Adequate

It is very hard for a housekeeper to know exactly how much of each of the food substances or nutrients her family needs or exactly how much of each she is giving them. The exact amount which each person needs depends upon age, sex, size, and amount of work done with the muscles. An elderly person, or one of quiet habits, needs less food than a vigorous, young one; a large person more than a small one; a man more than a woman; grown persons more than children; and a farmer working in the hayfield, a mechanic, or a football player more than a man who sits at his desk all day.

In order to calculate exactly how much starch, sugar, fat, protein, etc. (or, what is equivalent to this, how much protein and energy), the family needs one would have to know exactly how much muscular work each member was performing and also exactly how much of the different nutrients each food contained and exactly how much each person would eat. This, of course, would mean a great deal of figuring. Fortunately, such exactness is not necessary in ordinary life. If a little too much or too little of one nutrient is provided at a single meal or on a single day a healthy body does not suffer, because it has ways of storing such a surplus and of using its stored material in an emergency. The danger would come if the diet taken week in and week out always pro-

vided too much or too little of some one nutrient. Against this danger the housekeeper can more easily protect her family.

Habit and custom help greatly, because they usually are based on what the experience of generations has proved is wise and healthful, though, of course, there are bad habits and outgrown customs in food as in everything else. Good food habits, it must be remembered, include cleanliness and order in everything that has to do with food and meals and leisurely ways of eating. Equally important are a liking for all kinds of wholesome foods, even if they have not always been used in one's home or neighborhood, and eating reasonable amounts, without being either greedy or over-dainty. Every effort should be made to train children in such good food habits. If older people have not learned them, they, too, should try to do so, for such things are very important not only to health but also to economy. To refuse to eat some wholesome dish simply because one is not accustomed to it may prevent the use of some very desirable and economical food. To feel that there is any virtue in providing more food than is needed shows poor taste as well as poor economy.

The health and appearance of the family are a good test of the wholesomeness of their diet. If they are strong, well developed for their ages, free from ailments, and full of energy and ambition, one may safely say their food agrees with them. But if they are listless and ailing, or not as well developed either physically or mentally as they should be, and if a competent physician finds that there is no special disease to account for these bad symptoms, a mother may well ask herself if the food is right, and if not, how she can make it so.

In such cases she might, for instance, apply for information on food and diet to her State leader in agriculture and home economics and to the home-economics department of her State agricultural college.

General Suggestions

It is believed that it is impossible to plan the meals for a family wisely without at least as much knowledge of how different kinds of food serve the body as this bulletin has given and that the safest short cut to good planning lies in considering foods in the five groups here described. Ways of making economical use of the materials in each group can not be discussed in this bulletin, but a few general suggestions for getting the most for one's money in the matter of food may be made here.

Use cereals (flour, meal, cereal breakfast foods, etc.) freely, taking pains to prepare them with great care and to vary the kind used from day to day if necessary to keep people from tiring of them.

Remember that a quart of whole milk a day for each child, to be used as a beverage and in cookery, is not too much.

Remember that while skim milk should never be substituted for whole milk as the principal food in a child's diet, it is as valuable as whole milk as a source of protein and mineral matters in the general diet.

Remember that, except in the case of milk for children, the amount needed of foods specially useful for body-building purposes—that is, meats and meat substitutes, fruits, and vegetables—is not large, but what is needed is needed very much.

Do not be ashamed to plan closely. Thrift in food

means providing enough food, neither too little nor too much.

Notice carefully how much of such staples as flour, sugar, milk, cooking fat, etc., is used each week for a month, and see if there are any ways of cutting down the quantity consumed.

Buy nonperishable materials in quantities if better prices can be secured and there is a good storage place in the home. Neighbors can sometimes club together to get lower rates.

Try to make the dishes served of such size that there will be enough to satisfy the appetite of the family and no unnecessary table and plate waste.

Do not be above noticing whether anything usable is thrown away with the garbage, which always shows how thriftily food is used in a household.

Many inexpensive materials can be made attractive and the diet can be pleasantly varied by a wise use of different flavorings.

"Finicky" tastes in food often prevent the use of many valuable materials which might be the means of saving money.

Good food habits are an important part of personal hygiene and thrift. Children get such habits by having suitable amounts of suitable foods served to them and then being expected to eat what is set before them.

True economy lies not only in buying wisely, but also in making the fullest possible use of what is bought.

U. S. DEPARTMENT OF AGRICULTURE
FARMERS' BULLETIN NO. 871

FRESH FRUITS AND VEGETABLES AS CONSERVERS OF OTHER STAPLE FOODS

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Contribution from the States Relations Service
A. C. TRUE, Director

INTRODUCTION

Under ordinary conditions, 1 to $1\frac{1}{4}$ pounds of fresh fruits and vegetables (the equivalent of an apple or an orange, two medium-sized potatoes, and an average-sized helping of some other vegetable) is probably all that even a grown person really needs in the course of a day. He may desire more because of their fine flavor or refreshing character, but the necessary health-promoting substances would probably be obtained from the amount mentioned. These supply less then a tenth of all the fuel and the protein needed, but a relatively large part of the iron, calcium, and phosphorus.

Uses of Fresh Fruits and Vegetables in the War Emergency Diet

In an emergency, when fresh fruits and vegetables are relatively abundant they may with advantage be used partly to replace cereals and sugar, and to a less extent meat. Under such circumstances it is the part of wisdom to examine the list of fruits and vegetables and to see which can be used in such a way as to save cereals or sugar, and which used in such a way as to save meat.

Fresh fruits and vegetables can be used in large quantities with little danger, providing they are carefully cleaned and handled. It is even safe to say that there is absolutely no danger from the fruits and vegetables themselves, the only real difficulty lying in the fact that, being bulky, they quickly satisfy the appetite and sometimes lead people to leave out of their diet the more substantial foods—meats, cereals, etc.—which are needed either for fuel or for body-building purposes. This fact should always be kept in mind in finding uses for these bulky foods.

Classification of Staple Food Savers

Under the present unusual circumstances, the various fresh fruits and vegetables may be classed as follows:

Meat Savers. Shelled green peas, shelled green beans (Lima, kidney, etc.), shelled green cowpeas (common in the South), shelled green soy beans (common in the South).

Cereal Savers. Potatoes, sweet potatoes, partially ripe bananas (cooked).

Sugar Savers. Sweet potatoes, all fruits.

Using Shelled Green Beans and Peas to Save Meat

Beans and peas contain more protein than other fresh vegetables. This, however, is not the same as the proteins of meat, milk, or egg, and should not be used to the exclusion of the others. When, however, beans and peas are freely used, less milk, meat, and eggs are needed. For these reasons these vegetables are here called, not meat substitutes but meat savers. The following foods or combinations of foods supply as much protein as one-fourth pound of beef of average composition:

Eight or 9 ounces of shelled green peas or beans. A large dish of green peas may be used in place of meat for dinner occasionally. Many persons like peas cooked with mint or served with mint sauce.

One egg and 4 or 5 ounces of shelled green peas or beans. An omelet with peas (1 egg and 1 cup peas per person) or a baked pea or bean soufflé may be used as a meat substitute. (See recipe on p. 60.)

One cup skim milk and 4 ounces of shelled green peas or beans. A Lima bean chowder made with skim milk is a good lunch or supper dish. (See recipe on p. 60.)

Using Potatoes to Save Cereals

A small potato (3 to 4 ounces) supplies as much starch as a large slice of bread (1 ounce), but rather less protein. Potatoes eaten abundantly make it possible to get along with less bread. Potatoes can be substituted for about one-fourth of the wheat flour used in making ordinary bread and rolls. Recipes are given in Farmers' Bulletin 807.[1] These call, however, for old rather than new potatoes. Mashed potatoes may be used in place of biscuit crust in making meat pies.

[1] Bread and bread making in the home.

Mashed potato, sliced and fried may be used in place of bread and butter and makes a good breakfast dish. A very large variety of attractive salads may be made by combining potatoes with other vegetables—peas, beans, beets, cucumbers, radishes, onion, etc. Cottage cheese and potato salad go well together. This cheese has always been made in small quantities in the home, and now the Department of Agriculture is recommending to dairymen that they make it as a means of utilizing their large quantities of skim milk. This should make cottage cheese a more common article of trade than it has been in the past.

Sweet potatoes can be used in the same way as white potatoes. Bananas baked or fried supply considerable starch, though the amount can not be exactly stated, because as the fruit ripens the starch changes to sugar. Green bananas peeled and boiled can be used like mashed potatoes, or may be sliced raw and fried.

Using Fruits to Save Sugar

All ripe fruits contain sugar. The amount varies from about 3 ounces or $\frac{1}{5}$ cup per pound in fresh figs and plums to about $\frac{1}{2}$ ounce per pound in watermelon.

If the water is driven off from fruits, as in the drying process, the sugar becomes far more prominent than it is in fresh fruits. Dried fruits, therefore, taste far sweeter than fresh ones and are for this reason often classed among the sweets. It should be remembered, however, that sugar is present in all fresh fruits, even in the most acid ones, and that those persons who wish to do so can economize on other kinds of sugar by eating large amounts of fresh fruits in unsweetened forms.

In warm weather melons and other fruits may be used in place of "made" desserts, which usually contain both butter and sugar. Fruit and ice-cold junket, which can be prepared from skim milk, make a refreshing dessert and utilize perishable foods chiefly. Or the dessert course may be omitted entirely and a fruit salad with cottage cheese may be used in its place.

Making Fresh Fruits and Vegetables Help out on the Protein and Fuel of the Diet

The following list of foods provides a day's ration for three men or four women (about 11 ounces of protein and over 10,000 calories). It is suitable for those who can get large supplies of fresh fruits and vegetables. These foods supply over one-fifth of the protein and nearly a third of the fuel, whereas in the amounts used in the ordinary mixed diet they seldom supply more than a tenth of either.

	Pounds.
Cereals of various kinds (wheat flour, corn meal, etc.)	1½
Beef of average composition	¾
Milk	2
Cottage cheese	½
Potatoes	3
Shelled green peas or beans	1¼
Other vegetables, including those served cooked and those used raw as salads	2
Fruits (the equivalent of 6 quarts of strawberries, 12 large oranges, or 16 large apples)	6
Fat (butter, butter substitute, lard, oil, and other fats), 1 cup	½
Sugar, 1 cup	½

These foods could be served as follows:

A Day's Bill of Fare

BREAKFAST

Fruit, 2 quarts berries or 2 pounds of grapes, or the equivalent in any other fruit.

Cereal, 4 ounces uncooked, equal to 2 cups of mush.

The richer half, or "top," of 2 quarts of milk.

Toast, 4 ounces, the equivalent of 4 very large slices or 8 very small ones.

Butter, 2 ounces, or 4 cubic inches.

Sugar on cereal or fruit, or in coffee, tea, or cocoa, 2 ounces, or $\frac{1}{4}$ cup.

LUNCH OR SUPPER

Cottage cheese, $\frac{1}{2}$ pound.

Vegetable salad: Four potatoes, an equal amount of another vegetable (cucumbers, beets, string beans, peas, or any other), 2 ounces of oil, bacon fat, or other fat.

Crisp corn bread (1 cup or 8 ounces of corn meal, 1 pint skim milk. For recipe see Farmers' Bulletin 565.[1])

Butter, fruit, and sugar, as in breakfast.

DINNER

Meat pie with mashed potato crust, using 1 cup milk in crust.

Peas, $\frac{1}{2}$ peck unshelled, or 20 ounces shelled.

Bread, 4 ounces.

Fruit shortcake (2 pounds of fruit, $1\frac{1}{2}$ cups of flour, 2 to 4 tablespoons of fat, 1 cup of milk, $\frac{1}{2}$ cup of sugar).

Butter or other fat on bread or with vegetables, 4 to 6 level tablespoons, 2 to 3 ounces.

Vegetable Recipes

It should be remembered that the simplest way to serve vegetables is also a good way, i.e., to boil, steam, or bake them and to serve them either with salt only or with a little butter, milk, or cream. How-

[1] Corn meal as a food and ways of using it.

ever, when large amounts of vegetables are to be introduced into the diet, as at present, it is desirable to know a variety of ways in which to prepare them. For this reason the following recipes are given.

Vegetable Soups

Good vegetable soups may be made by finely chopping any vegetable or combination of vegetables and cooking in water with a little rice or farina for thickening. The chopping is most conveniently done with a food grinder. The following recipe calls for a combination of vegetables, which is only one out of many which can be used. Left-over vegetables can be used in soups of this kind.

VEGETABLE SOUP

2 turnips.
2 potatoes.
1 onion.
6 stalks celery with tips.
2 carrots.
1 quart water.
6 tomatoes or 1 pint can of tomatoes.
2 sprigs parsley.
$1\frac{1}{2}$ teaspoons salt.
$\frac{1}{4}$ teaspoon pepper.
2 tablespoons rice.

Wash and pare the vegetables and put them through the meat chopper, using the finest blade. Combine all the ingredients and cook until the vegetables and rice are soft.

The water in which rice has been cooked may be used in preparing this dish instead of rice itself.

Milk-Vegetable Soups

These soups offer a good way in which to utilize vegetables and also skim milk, which is often thrown away.

MILK-VEGETABLE SOUP, METHOD NO. 1

The soup for which the recipe is given above can be made with milk, providing no acid vegetables are used. This has the advantage over some other ways of making

milk-vegetable soups of preserving all of the juices of the vegetables. The cooking should be done in a double boiler to prevent scorching and curdling. This is a slow process, however, for the temperature in the double boiler is below the boiling point, and for this reason the vegetables should be chopped very finely.

MILK-VEGETABLE SOUP, METHOD NO. 2

Milk-vegetable soups may be thickened with flour. The general proportions are as follows:

Ingredients.—Liquid, 1 cup. This may be milk (whole or skim), vegetable pulp, or the water in which vegetables have been cooked.

Fat, ½ tablespoon or less. This may be butter, butter substitute, or drippings. The fat from bacon or salt pork gives a particularly good flavor.

Flour, ½ tablespoon.

Method of Preparing.—Melt the butter, add the flour, and cook one or two minutes, being careful not to brown. Add the liquid and stir until the mixture thickens. Season with salt and pepper.

The following is a typical recipe:

STRING-BEAN SOUP

2 quarts string beans.
¼ cup flour.
¼ cup or less of fat.
1 small slice of onion.
Salt.
Pepper.
Milk, whole or skim, enough to make 2 quarts of soup.

Cook the beans until tender in as little water as possible, drain, and rub through a sieve. Add the bean liquor and milk enough to make 2 quarts. Melt the butter, add the flour, and cook carefully one or two minutes. Add the liquid and cook until the mixture thickens. Season with salt and pepper.

Part of the beans can be cut into small pieces and served in the soup, if desired. The addition of large amounts of such pieces and of sliced potatoes converts the soup into a chowder.

MILK-VEGETABLE SOUP, METHOD NO. 3

Soups can be thickened with stale bread, which makes it possible to utilize still another food sometimes thrown away. Half a small slice of bread or about $\frac{1}{4}$ ounce of bread is enough to thicken 1 cupful of soup. The following is a typical recipe:

LETTUCE SOUP

1 head lettuce, or the equivalent in the outer leaves of lettuce.
1 small slice onion.
2 quarts skim milk.
1 large slice of stale bread.
Butter or other fat, if desired.
Salt and pepper.

Put the lettuce and onion through the meat chopper with the bread to save the juice. Put into a double boiler with the skim milk and cook until the lettuce is soft. Add fat (if desired) and the salt and pepper.

Vegetable Chowders

Vegetable chowders offer another good way of using vegetables and also skim milk. They differ little from milk-vegetable soups made according to Method No. 1, except that less liquid is used and the vegetables are usually cut into small pieces instead of being chopped finely. For this reason chowders seem more substantial. As in the case of the vegetable soups, it is a mistake to be confined to any definite recipe, for under these circumstances materials are often wasted which should be used. The following typical recipe is therefore only suggestive:

MIXED VEGETABLE CHOWDER

$\frac{1}{4}$ pouna salt pork or bacon.
1 onion.
6 medium-sized tomatoes or 1 pint stewed tomatoes.
1 green pepper.
4 medium-sized potatoes.
3 carrots.
2 cups skim milk.
2 tablespoons flour.
2 teaspoons salt.

Put the bacon or pork, onion, and pepper through the meat chopper and cook carefully about 5 minutes. Add the water and tomatoes and cook until the vegetables are tender. Cut the potatoes and carrots into small pieces and cook in water until tender, drain, and add with the skim milk to the other ingredients. Thicken with flour mixed with a little cold milk.

LIMA-BEAN CHOWDER

¼ pound salt pork.
1 onion.
1 green pepper.
3 cups skim milk.
1 pint or ½ pound green shelled Lima beans.
4 small potatoes.
Salt and pepper.

Put the pork, onions, and pepper through the grinder. Cook carefully for 2 or 3 minutes, being careful not to burn. Add either the beans or the potatoes with water enough to cover and cook until the vegetables are soft. Cook the other vegetable separately and when soft add with the milk to the other mixture. Reheat and season.

The protein in the above dish is equal to that in about ¾ pound of beef of average composition.

Any vegetable may be used in place of the beans. Corn and salsify are perhaps oftenest so used.

Vegetable Soufflé or Baked Omelet

These dishes are a good way to combine eggs and vegetables. If made with the green shelled legumes (peas, beans, soy beans, or cowpeas), they may be considered meat savers.

GENERAL RECIPE

(1) A thick sauce made with ¼ cup fat, ¼ cup flour, and 1 cup liquid which may be milk (whole or skim), cream, meat stock, or the water in which vegetables have been cooked.

(2) 1 cup thick vegetable pulp made by draining cooked vegetables and then mashing them or putting them through a sieve.

(3) 3 eggs, the whites and yolks beaten separately.

(4) Flavoring. Salt, pepper, onion juice, and any one of the following may be used: Very finely chopped parsley, chives, or ham, or $\frac{1}{8}$ teaspoon curry powder. Bacon used in making the sauce gives a good flavor.

Mix the vegetable pulp, seasoning, sauce, and well-beaten egg yolks. Carefully fold in the well-beaten whites of the eggs, put into a buttered baking dish, and bake in a slow oven until firm.

The amount of vegetables in this dish may be increased by serving vegetables around the soufflé.

The following is a typical recipe in which the protein is equivalent to that in 10 or 11 ounces of average beef.

GREEN-PEA SOUFFLÉ

$\frac{1}{4}$ cup fat.
$\frac{1}{4}$ cup flour.
1 cup skim milk.
1 cup mashed cooked peas (which will require about $\frac{1}{4}$ peck peas).
3 eggs.
Salt.
Pepper.
A few drops onion juice, or a very small piece of onion boiled with the peas.

Combine the ingredients as directed above.

Other Vegetables

Directions for preparing these vegetables in other ways and also for preparing vegetables not mentioned above can be found in Department of Agriculture bulletins.

Conclusions

When fresh fruits and vegetables are abundant and cheap they can be used in large enough amounts to effect an important saving of staple foods. If used intelligently, there is no danger that the diet will lack fuel or protein. Fresh legumes may be used to a certain

extent in place of meat, potatoes in place of bread, and fruit in place of sugar. In connection with these foods, however, it is safe and highly desirable to use skim milk and its products, which, like fresh fruits and vegetables, are perishable and can be profitably used near the place of production.

U. S. DEPARTMENT OF AGRICULTURE
FARMERS' BULLETIN NO. 375

CARE OF FOOD IN THE HOME

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Prepared under the Supervision of the Office of Experiment Stations
A. C. TRUE, Director

INTRODUCTION

THE woman who presides over a household should consider as one of her most important functions the purchase of food and its storage preliminary to use in the kitchen. Should she be living on a farm she will buy less in amount than the woman who lives in the town or city, but, on the other hand, the storage of food will demand more of her attention. In both cases, if intelligence and care are lacking, financial loss will ensue and the family table will be less attractive and wholesome than it should be.

Most families have traditions and well-established customs to guide them in the handling and storing

of foods, but since the customs of one family may differ widely from those of another, it is well to examine and compare them in order to select the best. Scientific investigation has also thrown light on many of the processes concerned and the result of such labors should be at the service of the householder. The health and efficiency of the family is the chief object of her care, and it is an end well worth the effort.

Yeasts, Molds, and Bacteria, and the Spoiling of Food

In the buying, storing, and handling of food it is most important that we realize the causes of what is called the "spoiling" of food. This knowledge is comparatively recent.

The Nature of Yeasts, Molds, and Bacteria

Countless numbers of tiny living things called microorganisms, a word meaning simply "small living things," are everywhere found which will grow in the food man has prepared for his own use and cause it to spoil. Indeed, the kind of food required by man and animals seems to be that which is also best suited to these microscopic plants.

It is this very demand for highly organized food which brings them into such close relation to all problems that concern the food of man. These microscopic plants flourish in the kitchen, storeroom, ice box, milk room, and cellar. If the conditions are favorable they reproduce themselves with incredible rapidity, one bacterium in the course of a day producing a million more minute plants like itself. The bulk of these minute forms of life are harmless, under certain conditions; some are useful, like those which

ripen milk; and many are harmful, since they cause waste or may be, what is much more serious, a direct cause of disease.

Molds, yeasts, and bacteria may be found in the cleanest room, but they exist in far greater numbers in dirty quarters, where, for instance, crumbs of food have been allowed to decay and dust to accumulate. Not only do the micro-organisms appropriate our food, with the result that the food sours, rots, or putrefies, but they sometimes, in addition, leave behind disagreeable consequences like the musty and moldy odor and flavor of some spoiled foods, or the substances called ptomaines, which are sometimes poisonous. The housekeeper's success in preserving food from deterioration depends very largely on her ability to reduce the number of these unbidden guests to the lowest possible limit.

The science of bacteriology has given us a new meaning for the scrubbing, airing, and sunning that for many generations good housekeepers have successfully practiced; it shows us that the storing and handling of foods are essential bacteriological questions, and on that account some knowledge of the nature of these microscopic plants is here in order.

Yeasts and their Utilization

Not until millions of yeast cells are massed together do they become visible to the eye as in the compressed yeast cake. Yeast plants are practically everywhere and are of many varieties, some being called "wild yeasts," in distinction from those we have learned to cultivate for the making of bread and brewing of beer, and the fermentation of wine and cider. The old-fashioned method of making "milk-rising" or

"salt-rising" bread depended on wild yeast falling into the dough and causing the bread to rise, a method not always successful, because other organisms, the bacteria, also had a chance at the dough and sometimes got the better of the yeast in the struggle for food, and the result of their life in the dough was sour or bitter bread.

Even when we are able to utilize the life processes of the yeast plant, its good offices are paid for with a certain amount of food material; thus, when introduced into the bread dough it breaks up part of the sugar present into alcohol and carbonic-acid gas, and the gas becomes tangled and stretches out in the glutenous mass, making the porous loaf which at the right moment is stiffened by the heat of the oven.

In the same way the wild yeast attacks the sugar in the stewed fruit that has stood exposed on a warm day, or the jelly left uncovered, or sometimes even when apparently covered, only in these cases the gas evolved serves no useful purpose and the fermentation ruins the taste of the food.

Yeasts grow best at a temperature of 70 to 90° F.; therefore, food that is to be protected from their action must be kept well below this point.

Molds and their Prevention

The appearance of mold as growing on bread, cheese, and other foods is familiar to every housewife; mildew on cloth is a less commonly recognized form of mold.

The spores (i.e., the minute reproductive bodies) of the different varieties of mold are everywhere present, and they need only warmth and moisture to enable them to grow on many kinds of food. These organisms are always at work in damp cellars and in dark and

damp corners of rooms; they are borne on the feet of insects, they are on the skins of all fruits, and in the dust flying in the air. They are not fond of light and they require no great abundance of air, flourishing best in foods that are piled close together, leaving small undisturbed air spaces and moisture. They always start on the surface and throw their thread-like filaments down into the substance below. Take, for example, a fine ripe apple and closely examine the skin. If it is in good condition and attractive it is almost certain that the flesh is protected in the natural way by an unbroken skin which resists the entrance of molds and other micro-organisms. If, however, the apple has begun to spoil, it is almost certain that the skin has been broken.

When fruits touch each other, the point of contact is likely to be moister than the rest of the fruit, and for this and other reasons it is a favorite place for the starting of mold or other growth. If the skin is perfectly firm and we rub it with a clean cloth to dry it and to remove as many as possible of the mold germs, then wrap the apple in soft paper and put it in a cold place, precautions have been taken which should hinder or prevent decay. If, however, the fruit is kept in a warm and damp place, and touching other fruits, its decay is certain. In dealing with all varieties of microscopic life we have learned that to prevent them from getting a start is the all-important thing. The growth, once begun, is difficult to arrest.

The first requisite is absolute cleanliness in the storage place. This is not to be attained by the use of soap and water alone. Fresh air, sunshine, and whitewash are important aids. Shelves should be washed clean and then dried; but the undue use of water

should be avoided, as moisture is one of the chief requisites of growth. A cellar may be kept dry by placing in it dishes of unslaked lime, which takes up the moisture with avidity. When the lime crumbles apart, losing entirely its crystalline character, it has become "slaked," will take up no more water, and must be renewed.

The growth of most molds is retarded by light, ventilation, and low temperature. Light and ventilation are important. The right degree of cold for each different product has been studied experimentally, and a knowledge of low temperature in relation to the growth of bacteria and fungi forms the basis of the cold-storage industry.

Bacteria and How to Control Them

From the standpoint of household sanitation bacteria are by far the most important of the three groups of micro-organisms under consideration. They are many times smaller than the yeasts, and their power of reproduction is almost unlimited. They require at least 25 per cent of moisture in which to live and multiply, and they prefer darkness to light, and while as a class they grow best at a comparatively high temperature, 80 to 95° F., most of them are killed by an exposure to 150–160° F. of moist heat. A repeated application of boiling temperature is necessary, however, to kill the spores which certain kinds produce.

Bacteria are very widely distributed; the soil teems with them; they are in the air, in water, and in all food exposed to dust and air, milk being a favorite habitat. The flesh of healthy living animals is free from them, but when slaughtered and marketed the surface is almost certain to acquire bacteria, like all

things which are exposed to air and dust. They are inside the human body, often performing important functions, as in intestinal digestion. In short, wherever organic material is exposed to their inroads there they are found.

It is said that the numbers of bacteria are in direct relation to density of population. We can not get away from them without going into the highest mountains or to the polar regions; but we can protect our food supply from their undue growth by reversing all the conditions that they require for their development.

It is of primary importance that bacteria be prevented from getting their start. Hence, only such foods should be bought as are in the freshest and best possible condition. Since succulent fruits, milk, raw meat, and meat products are especially subject to bacterial action, they must be given unusual attention. They should be consumed as soon as possible after purchase or subjected to the following conditions: Utensils that come in contact with them must be thoroughly scalded, or better, boiled. The hands and clothing of the worker must be kept clean and every effort made to avoid contact with dirt. Of cooked foods, moist vegetables, cooked fruits, moist made dishes like meat pies and similar dishes are particularly liable to "spoil" or "sour," and the importance of clean utensils, of keeping the foods protected from dust, etc., can not be too often pointed out.

The temperature at which food is kept should be reduced to that best suited to it, which is usually as near the freezing point as possible. Highly putrescible food, as meat, is thus kept for months in cold storage, and a good ice box will keep such food for days in per-

fect condition. Cool, clean storage is as important for many cooked foods as for raw.

Since the water content of food must be above 25 per cent before bacterial life is possible in it, we may preserve food by drying it. This method, often in combination with salting and smoking, is applied to fish, meat, vegetables, and fruit.

By exposing food to 150–160° F. of heat for half an hour all varieties of bacteria would be killed except a few that are very resistant to heat. In the case of spore-forming bacteria, the spores would in certain cases resist this degree of heat. The pasteurization of milk offers a familiar example of a food that is kept from spoiling by this method.

After thorough boiling food may be sealed from the outer air by the well-known method of canning.

Most varieties of bacteria are killed in a few hours by direct sunshine, but it must be direct. The recesses of a dark room are little affected by what sunshine may filter into its depths. Contents of storerooms should now and then be sunned, and such rooms should be regularly aired.

We may often make use of substances that inhibit bacterial growth. These tiny organisms can not live in a very heavy sugar solution, a fact made use of in preserving fruits. Vinegar, spices, salt, and wood smoke have a like effect, and their use is familiar in pickled and spiced vegetables and fruits and in salted and smoked meats.

Ptomaine Poisoning

In some foods bacteria in the early stages of their action leave no disagreeable or unhealthful effects, so far as yet proved. Meat is in some measure ripened

by bacterial action, and the "gamey" taste given meat by "hanging" comes in part from the same cause, though in both cases the changes are chiefly due to the action of ferments normally present.

It is not easy to draw the line between the harmless ripening processes and the bacterial changes classed as decay, but if the bacteria are allowed to grow without hindrance the time comes when the food, either animal or vegetable, attacked by bacteria, breaks up into a loathsome mass.

The food may become dangerous even before it shows outward signs of decomposition, for the bacteria may, as they feed upon the proteids, give off substances known as ptomaines, hardly to be recognized without laboratory apparatus, but some of which are very poisonous to man. Certain apparently mysterious cases of illness have been traced to such causes, and milk, fish, meat, cheese, baked beans, ice cream, and other foods have all been found responsible for "food poisoning." It is no uncommon thing to hear that a large number of the persons attending a banquet were taken violently ill within a few hours after, all with very similar symptoms. In some cases the illness has been of brief duration, in others it has continued for days, or even resulted in death. In one instance the offending food may have been lobster salad, in another, cold-storage chicken, in still another, ice cream. These severe cases of wholesale poisoning generally occur in the summer and after a very heated term. Doubtless many milder cases, called summer complaint, are due to the same cause. This sort of poisoning is not a true bacterial disease; that is, it is not due, as is typhoid fever, to the growth of an organism in the body, but the illness results from the introduction

into the system of poisonous substances already formed in the food by the bacteria.

It is not known under what conditions these peculiar poisons are developed in foods; we know only that they are the result of bacterial action not so advanced as to give warning to the senses. It is a safe rule to eat very sparingly of foods which are liable to such changes in hot weather, and especially where the methods of preparation are not known or where the serving of a large number of people at the same time brings an undue strain on the culinary forces, in which case material is certain to be served which has been prepared a considerable time in advance and not properly cooled and stored.

Disease "Germs" and Polluted Water

The so-called "germs" of typhoid fever, diphtheria, and tuberculosis are bacteria, and as they may be conveyed by means of water or food this danger is a very real and serious one.

As a proof that contaminated water is the direct or indirect source of typhoid-fever infection it may be mentioned that the statistics of 10 large European cities whose water supply is drawn from pure mountain lakes and streams showed in 1905 a death rate very much lower than that of a large number of American cities whose average death rate from typhoid fever was 34 per 100,000 inhabitants.[1]

The germs of typhoid fever, like those of cholera, are voided in the feces and urine of the patient. Because of carelessness or ignorance in the disposal of these excreta they find their way into surface drainage, reach brooks and streams, and defile wells. Such

[1] Jour. New England Waterworkers' Assoc., 19 (1905), No. 4, p. 575.

infected water used as a beverage may readily cause typhoid. By means of milk cans washed in such water, or by the hands and clothing of persons who have nursed typhoid patients, the germs are planted in milk, and in this nutritive medium they develop with wonderful rapidity, so that milk becomes, next to water, the great carrier of typhoid. It is also known to have carried diphtheria and scarlet fever and it has well been called the most valuable and the most dangerous food. The relation of flies and dust to typhoid and other diseases is discussed later.

For protection from a polluted water and milk supply we must look chiefly to sanitary laws and their rigid enforcement. In such laws the housekeeper who is seeking to guard the health of her family has, or should have, the most lively interest. She should understand them herself, report any cases of disobedience that may come to her notice, and be willing to work for the passage of better laws if they are needed.

If the water supply is not known to be well guarded from pollution, the existence of a disease like typhoid fever in any locality requires that the greatest precautions must be taken in every house. The drinking water must be boiled to destroy any disease-producing bacteria possibly contained in it, and this boiled water must be used for cleaning the teeth, for washing such vegetables and fruits as are consumed raw, and also in rinsing dishes and cooking utensils.

The tubercle bacillus, the cause of tuberculosis, should also be guarded against, though it is not likely to be carried by city water. Food may become infected with it from contact with a person suffering from the disease, and it is not unreasonable to forbid any such to aid in preparing meals. It is also a reason-

able measure to prohibit the sale of milk from a farm where the disease is known to exist.

The Necessity of Caution in the Use of Raw Foods

The numerous cautions suggested in this bulletin may seem unnecessary, but a few facts will show that they are not extreme.

In older civilizations, where the soil has been exhausted and needs constant manuring, cooked fruit and vegetables rather than raw are much more the rule than with us. In densely-peopled China, where night soil is used to fertilize the land, the eating of raw vegetables is said to be very rare. It is easy to see why such foods uncooked might be very dangerous. Although such methods are not followed to any great extent in the United States, raw fruits and vegetables may be a menace to health. Methods of washing fruits and vegetables are discussed in another section.

A Russian authority, Professor Metchnikoff,[1] because of the possible presence of disease micro-organisms and minute animal pests, as intestinal worms, strongly advises against the eating of any raw food whatever, even if it has been washed in boiled water. Although this view may be considered extreme for American conditions, it shows what care must be taken in the purchase and the cleaning of food that is to be consumed raw.

Kitchen methods in many of their details fail to meet the requirements of sanitary science. The cook is not trained in bacteriology; she does not know what cleanliness means from the laboratory point of view. The old-fashioned hatred of dirt for its own loathsome sake is the best substitute for this knowledge, but

[1] The New Hygiene. New York, 1907.

it is not enough. For instance, boiling has long been known to kill whatever was the cause of "spoiling" of food. However, most housekeepers did not "boil out" the milk pans, etc., but simply scalded them. "Scalding" is an indefinite term; if boiling hot water is used, and enough of it, scalding would doubtless be effective, but too often when the facts in the case are not thoroughly understood such a process is carelessly carried out and the desired end is not accomplished. When in such cases the milk spoils very quickly it is often attributed to the weather or to bad luck. The housekeeper who understands the causes of spoiling, and who knows that the microscopic plants responsible for it may be destroyed by a sufficient degree of heat applied for the proper time, is much more likely to be successful than one who works by rule of thumb. Here, as in so many other household problems, knowledge is essential. How is the ignorant cook to know that what lurks unseen in crack or seam may bring to naught all her precautions? The homely old dictum that the only way to conquer dirt is by "eternally keeping at it" is as true as ever it was, but as we have come to realize more and more the insidiousness and omnipresence of the enemy to health, and that in the form of bacteria it consorts with dirt, we realize also that every housekeeper and houseworker must be made to understand something about the microscopic forms of life which are harmful, and how to apply all the weapons which modern science has discovered for their destruction.

Flies and Food

The intelligent housekeeper of this generation has at her command a wealth of scientific knowledge that

may be applied to the solution of problems in home sanitation. Of great value are the means which have been devised, thanks to the work of the Bureau of Entomology of this Department, the agricultural experiment stations, the state boards of health, and investigators in many universities and other institutions, to prevent the spread of disease by insects and other forms of animal life. In the nature of things, the importance of this matter was not recognized until it had been shown with certainty that such animal life played an important part in the transmission of disease. Two varieties of mosquitoes are generally conceded to be absolutely necessary to the transmission, respectively, of malaria and of yellow fever, since the organism that causes these diseases must first undergo a complicated series of changes in the body of the insect before it is capable of producing a new case. Thus, the mosquito bites a yellow-fever patient and takes the micro-organism into its body, and there for some twelve days it is developed to the stage of maturity, after which time and not before the mosquito can convey the disease by biting. In such cases the insect is called an "intermediary host." Both diseases are now successfully fought by exterminating the breeding places of the mosquito and by the screening of dwellings.

Insects play a still larger part as mechanical carriers of disease germs, the greatest menace of all in our daily life being the common house fly, known to scientists as the *Musca domestica*. It is not a biter, like the horsefly and some other flies, or like the mosquito, but it has its own way of carrying infection. It breeds in manure and it feeds on it; it feeds on the sputum of diseased throats and lungs, on typhoid dejecta,

and refuse of all kinds, and by means of its hairy feet and legs it carries about and distributes particles of these vile feasts, which frequently contain living germs capable of producing a new case of disease. In still another way does the fly spread disease—disease germs taken into its body in food are known to remain alive in the intestines and also for days after they are ejected in the "specks," i.e., in the fly excrement. By recent experiments with animals this has been proved true of both the tuberculosis and the typhoid bacillus, the germs in the "speck" having actually given the disease from 9 to 15 days after it was voided by the fly. Also the eggs of worms that it draws into its body with water that it drinks are known to remain alive and to hatch after being ejected.

The case against flies is well proved, and yet they are allowed to infect the joint of meat exposed for sale by the butcher, the bread and sweetmeats of the confectioner's counter, berries and other fruit, the edge of the milk pail, the kitchen table and utensils, and the food of our table. They were shown to be the principal carrier of the typhoid fever which attacked 20 per cent of the United States soldiers in the Cuban war and furnished 86 per cent of the deaths. As the report[1] states, "Flies undoubtedly served as carriers of infection. . . . It is probable that the infection was [also] disseminated to some extent through the air in the form of dust." Furthermore, it is pointed out that the men undoubtedly spread the disease by means of infected material conveyed on their persons and clothing. Water was not regarded as an important factor in the spread of typhoid fever in the

[1] Abstract of Report on the Origin and Spread of Typhoid Fever in United States Military Camps during the Spanish War of 1898. Washington, 1900.

national encampment of 1898. Since that time so may well-proved cases have been traced to the fly that Dr. L. O. Howard [2] recommends that the name "typhoid fly" should be generally adopted, in order to call attention to the danger of allowing this insect access to our dwellings.

In the monthly report of one of our state boards of health [3] is graphically described a scene familiar to many of us:

> In front of a grocery, boxes of blackberries were exposed for sale. They were slightly gray; dust and swarms of flies were present. On the sidewalk, within 6 feet of the berries, some poor diseased mortal had spat, and this sputum was circled with flies. A moment's observation showed that they flew back and forth, not only between the berries and the sputum, but also between the berries and the gutter filth and street manure. But, most wonderful, people purchased those nasty berries and ate them raw.

It was found later that much diarrhea existed in the neighborhood, caused possibly by bacteria transmitted by these very flies.

We are far too tolerant of the presence of this filthy and dangerous insect. Its breeding grounds should be the first point of attack. The Bureau of Entomology of the Department of Agriculture has given a great deal of attention to the matter, and the publications of the Bureau should be consulted for full data on the subject. A summary may be found in an earlier bulletin of this series.[4] On the authority of this Bureau it is stated that at least 95 per cent of the town and city flies are bred in heaps of horse manure left in roads, fields, and stables. The remedy proposed

[2] U. S. Dept. Agr., Bur. Ent. Bul. 78.
[3] Mo. Bul. Ind. Bd. Health, 10 (1908), p. 64.
[4] U. S. Dept. Agr., Farmers' Bul. 155.

is stricter enforcement of the laws governing the cleaning of streets, and the covering of all manure pits in town and country, with occasional spraying with crude petroleum. The manure pile and the barnyard are the fly-breeding ground of the farm.

To urge the housewife to work for public measures to insure such sanitary reforms is not asking her to go too far afield. In her own house she will endeavor by the use of screens and fly paper and similar means to protect herself from this dangerous insect. But she will wage an unequal battle unless the root of the evil is attacked, and this can only be done by removing manure and other refuse, that form the breeding places of the fly. This question is considered in the government documents referred to.

Briefly, the manure should be collected in pits where it may be kept covered, or where it may be treated with kerosene oil or some other material which kills the eggs and larvæ. It is of still greater importance that flies should never have access to human excreta.

Dust in its Relation to Food

What is the composition of dust? It has been described as a little of everything. In the paved streets of cities and towns earthy particles from the soil are always present. While street dust in the country is largely made up of powdered earth of the road mixed with finely ground manure, in cities its lighter particles are principally dried horse manure with more or less dried powdered sputum; facts sufficiently disgusting to give us a hearty aversion to dust as an accidental accompaniment to any article of food. The dust of rooms contains earthy particles, minute fragments of

clothing fiber, bits of abraded skin, and pieces worn away from walls, floor, and furniture, also mold spores, bacteria, and street dust in greater or less quantity, according to the location.

Every precaution should be taken if there is illness in a house, particularly tuberculosis or other infectious or contagious disease, to prevent the micro-organisms which cause the disease from getting into the air and dust. Dr. Michael Prudden[1] gives the results of attempts to count the bacteria in the dust of New York streets. A culture plate of $3\frac{1}{2}$ inches in diameter was exposed for 5 minutes with the following results: Central Park, near street, collected 499 bacteria; Union Square, collected 214 bacteria; large dry goods store, collected 199 bacteria; street while being swept, collected 5,810 bacteria.

The daily examination of the milk of a certain model dairy revealed suddenly a great increase in the bacterial count. The physician and the bacteriologist examined the premises and watched every process in a vain effort to determine the cause until it was noticed that the milk pails were put to sun where the dust blew on them. This cause removed, the bacterial count returned to normal.

These air and dust bacteria are not necessarily harmful, but where large numbers are present there are likely to be among them those which produce disease. A number of cases of illness are on record directly traceable to fruit, but it is difficult to determine whether in such cases infection has come through dust settling on the food or through direct contact of the fruit with infected human beings.

Better market inspection is needed, better protection

[1] Dust and Its Dangers, p. 26.

for food from dust both in transit and when on sale, and a more rigid carrying out of existing laws, but, above all, a demand for clean food on the part of the buyer.

Precautions should also be taken against dust after the food is delivered at the house. In modern dairying much stress is laid on the fact that sweeping the stable before milking fills the air with bacteria which are likely to infect the newly drawn milk. The same danger arises if food and dishes are left exposed in kitchen or pantry during sweeping. Tests have been made to determine how great this danger really is in ordinary household practice, and it has been found not only that molds, yeasts, and bacteria are much more abundant in the air during sweeping, but that those stirred up by the sweeping do not settle back again for several hours afterward. Evidently, then, it is not sufficient to cover food and dishes during the actual sweeping; they should remain protected for some hours. Dusting with a dry cloth or feather duster also stirs the micro-organisms into the air; for this reason a damp cloth to which they will stick is greatly preferable for cleaning in kitchen, pantry, and china closet; in fact, everywhere. These considerations also show the great sanitary advantage of modern cleaning devices, of which a number of sorts are now on the market, by which the dirt is sucked through tubes into suitable receptacles. Bits of damp newspaper or damp sawdust sprinkled on a floor will hinder dust from rising when the room is swept, but the wooden or linoleum-covered floor of a well-kept kitchen and pantry should furnish very little dust. Larger particles should be lightly brushed up and the floor washed every few days.

Pet Animals in the Kitchen

Another possible source of danger, but one frequently overlooked, would seem to be the pet animals of the household. The fur of even the most cleanly cats and dogs must come in contact with many things which we would not care to have touch our food. In many families where the animals are not allowed in the living rooms for fear of soiling furniture they are given free range in kitchen and pantry, where the chances are they will leave more or less loose hair and dirt which may find its way to food utensils or to food.

A word should also be said regarding animal pests. Rats and mice are regarded by all housekeepers as destructive and disagreeable in every way, and no one cares to eat food which they have touched. Traces of the presence of mice may sometimes be noted in cereals and other foods sold from open boxes and similar containers in markets and shops which are careless in such matters. This suggests another reason for keeping such foods in glass jars or tin cans or similar receptacles in shops and in the pantry and storeroom. In addition to the food which they destroy and the pecuniary loss involved, rats and mice are a menace to health, as they are known to be carriers of disease. Many investigations have been reported which show their connection with the spread of trichinosis and with bubonic plague. Data summarized by the New York State Department of Health [1] indicate that the rat may be a large factor in transmitting diphtheria and other communicable diseases.

The question of the losses due to rats and methods

[1] Mo. Bul. N. Y. State Dept. Health, n. s., 4 (1909), No. 3, p. 74.

for destroying these pests are considered in an earlier bulletin of this series.[1]

The Food Supply

That food which is brought into the home shall be clean and of good quality is a matter of the greatest importance. Vegetables and fruits should be grown and milk and other dairy products produced under the most sanitary conditions only, and all the products of the farm and garden which pass through the dealer's or manufacturer's hands should reach the kitchen in a clean and wholesome condition.

Since the passage of the National Pure Food and Drugs Act, giving to the United States Government authority to enforce stringent laws against the adulteration and misbranding of foods which enter into interstate commerce, and the more rigid enforcement of similar state laws which regulate these matters in many of the States, a great burden has been lifted from the shoulders of the buyer. This legislation has enormously decreased the deceptions formerly practiced by some manufacturers, and since it insures that the name and description on bottle and package shall not misrepresent the contents, the buyer, if he knows what he wants, will have no difficulty in obtaining it, while the honest manufacturers and dealers (and they have without doubt always outnumbered the others) will also be protected. This matter in its various aspects is taken up in publications of the Bureau of Chemistry[2] of this Department.

The national laws regarding the inspection of meat and meat products are a further and very important

[1] U. S. Dept. Agr., Farmers' Bul. 369.
[2] U. S. Dept. Agr., Bur. Chem. Bul. 100; Yearbook, 1907, p. 321.

protection of the home food supply. Publications of the Bureau of Animal Industry [2] of this Department deal with the question of meat inspection in relation to wholesomeness and quality. But the buyer has still to choose among many varieties of food that have all met the requirements of the law. There are, for instance, many kinds of canned vegetables that should be carefully compared as to flavor and water content. A 10-cent can of tomatoes that consists of a little partly ripened pulp swimming in water may be much dearer than a 15-cent can with a lower water content. The writer compared two cans of tomatoes on the basis of the amount of pulp of a given consistency that they yielded on straining. As the 15-cent can yielded twice as much as the 10-cent can, and the pulp was also of a better flavor, the cheaper can should really have sold for 7 or 8 cents in order to vie with the other in real food value.

Clean Shops and Markets a Necessity

The buyer as well as the merchant is responsible for the dirty market and shop, for if they were not tolerated by the purchaser they could not exist. The condition of the food when it enters the home is a matter of the utmost importance in relation to the subsequent handling and use, and great care is to be exercised in choosing clean rather than dirty places in which to purchase food. As yet the buyer has but little protection through the enforcement of law regarding unhygienic conditions existing in places where food is offered for sale. Let us hope, however, that this state of things will soon mend. In some States the boards of health are already active in the inspection of

[2] U. S. Dept. Agr., Bur. Animal Indus. Circ. 125.

dairies, and the inspection of slaughterhouses has made great progress under the United States laws.

Even to the untrained eye the markets and provision stores are often dirty places. In too many of them all manner of foods are exposed to dust and flies, and in the long list may be found many that are "ready to eat," such as cooked meats, butter, cheese, bread, cake, figs, dates, pickles, and candy. In boxes on the floor, leaning at an angle against the counter, or on the pavement outside, may often be seen green vegetables, macaroni, and fresh fruits exposed to street dust which is in good part finely ground horse manure and other filth. A crate of berries may be seen on a stand outside unprotected from dust or from the visits of countless flies.

There are, of course, many market men and grocers who have clean, well-kept, and sanitary places of business, but the care of the market stall or provision store is too often in the hands of people who are not only ignorant of the hygienic reasons for avoiding dirt but also devoid of any real instinct for cleanliness, in so far, at least, as it applies to commercial matters. In such shops the meat block is seldom scraped and scrubbed, oysters are opened into dirty pails, and floors and shelves are infrequently cleaned. The grocer's assistant may come in directly from unharnessing the horse to take your crackers from the barrel, and his hands are not washed between drawing a fowl and cutting a beefsteak. The butcher or grocer's apron in a case recently noted served some of the uses of a handkerchief and yet it was in almost constant contact with food. Such topics are not pleasant, but conditions will not be mended until housekeepers take notice of such things, protest against them, and

confine their buying to the shops which are run by men who can be trusted to abolish all such uncleanly ways.

If the average person finds these conditions and practices offensive, because they are unclean and unnecessary, how much more disturbed are those who have learned that in addition such practices involve bacterial contamination of foods, some of which are eaten raw.

The praise and blame of the buyer has much to do with keeping up the standards of the dealer, and it is held by some writers that the growing use of the telephone in ordering the dinner, thus bringing about absentee buying, is responsible for many bad conditions.

If buyers will think of these things and patronize the clean, progressive, and sanitary shops in preference to the others it will do much to insure better standards. It is the opinion of many, however, that the law is, or should be, the final resource. In some cities associations of housekeepers have joined in demanding better hygienic conditions in markets and have obtained what they sought.

Sanitation of Bakeries

When we buy a loaf of bread in a shop whose counters are clean and whose show case carries a tempting array of cakes and rolls, we are not to conclude, as a matter of course, that the bakery at the rear or below stairs would also meet our approval. Not one customer in a thousand sees the conditions under which bread and pastry are manufactured, and it is this very removal from public view and criticism that constitutes the chief difficulty in enforcing existing laws for the proper

construction of bakeries and for sanitary methods of carrying on the business.

Not long ago one-half the bread consumed in London came from cellar bakeries, and while it is true that a cellar bakery may be hygienic, the chances are strongly against it.

There are, of course, very many sanitary and clean bakeries and workmen who are careful in their work and neat in habits, but the reverse condition too often prevails. One London bakery is described in a recent report as 30 feet long by 7 or 8 in width, with bags of flour ranged on one side and the dough tubs placed along the other. In the same room were found open sanitary arrangements, poor sewerage leaking out foul gases, a defective oven letting out fumes of coal gas, open cracks in the ceiling through which sifted dust from the store above, and the stifling air was unchanged by ventilation.

In one of our Northern States a few years ago health inspectors examined 547 bakeries in 25 towns and 3 cities and reported that from a sanitary standpoint 270 were distinctly bad, 222 not especially bad, 44 satisfactory, and 11 worthy of especial commendation.[1] Similar conditions have been found in other localities.[2]

Most difficult to change are the personal habits of the workmen where they are careless and lacking in cleanliness.

In some bakeries floors and even vats were scrubbed but once a year; in some there was no provision made for washing the hands.

From such bakeries most persons do not care to buy their bread, if they are willing that men should be

[1] Mass. State Bd. Health Rpt., 38 (1906), p. 607.

[2] Bien. Rpt. Bur. Labor and Indus. Statis. Wis., 13 (1908), pt. 5.

allowed to labor in such surroundings. It should not be forgotten that the buyer of food has many opportunities to help in raising standards that will affect the whole community. It is quite within the rights of the buyer to insist on inspecting the place where the food is prepared, but it is better to accompany the official inspector. Some of the bakeries will be found above reproach, and these are the ones which the careful housewife should patronize.

The inspection of bakeries is provided for by legislative enactments in some cities and States and is an important hygienic measure. Great improvements have been made in recent years in the construction of bakeries and in bread-making machinery and other equipment, all of which makes for more sanitary conditions. It is encouraging to note that progressive bakers realize the importance of cleanliness and sanitation and manifest a marked interest in all that pertains to such matters. As an instance of this may be mentioned the work of the bakers' institute in one of the Western States.[1]

It has been proposed that a law should require that the loaf of bread, as soon as baked, should be put in a paper bag and thus handled and transported, but it is sometimes difficult to carry out reforms of this kind if they conflict with the prejudices of the buyer. A baker in one of the large cities whose methods were known to the writer started this method but did not succeed in popularizing it. People wanted to "see the bread," and it entailed an expense which the buyer was not willing to meet and which the baker thought that his profits would not warrant. Other cities or bakeries have without doubt had a different experi-

[1] Bien. Rpt. Bur. Labor and Indus. Statis. [Wis.], 13 (1906–7), pt. 5, p. 719.

ence. At any rate, bread or rolls thus wrapped in paper, often of a transparent nature, are served in some restaurants and hotels and on some dining cars.

The Quality of Meats

In order to become a good judge of meats it is very helpful to have a few lessons from an experienced buyer. The different cuts will thus be easily learned, but the quality of the meat depends on so many factors, as the age of the animal, the breed, and the method of fattening, that it is easy to make mistakes in choosing, and the buyer will often be wise in accepting information from the dealer, if he is one who prides himself on keeping first-class meats. Having found such a one, the customer who wishes to save time and money will continue to buy of him. The very large amount of meat which some housekeepers provide is not necessary. In general it is better to use a reasonable amount of that which is in prime condition rather than to economize on the quality. The meat is easily supplemented by other dishes, and the whole meal will thus be better balanced than would be the case if a larger amount of inferior meat were provided. Although not generally understood, it is just as important that the cheaper cuts of meat, as well as the dearer ones, should come from a well-fattened animal.

The True Price of Meats

There is an apparent and a true price of meats, a fact that is not always considered. It may be more economical to pay 15 cents for a cut of clear meat than 8 cents for one that contains nearly half its weight of bone, sinew, and fat. The apparent price of chicken may be 20 cents a pound, but its real price will often

be 50 cents, when the weight of head, legs, entrails, crop, and bones is taken into account.

Poultry

There is much discussion regarding the merits of drawn and undrawn poultry. Most dealers contend that in warm weather a fowl which has had entrails and crop removed spoils much more quickly, because of the extent of cut surface exposed, than does undrawn poultry. The writer found in a large city market but one dealer who kept drawn poultry, and he said that he could not do so except for the fact that steady customers took all of his stock, so that nothing was left on his hands. The extra price that he charged per pound was only sufficient to make up for the loss in weight.

The Massachusetts State Board of Health[1] has recently studied this question and found that if the entrails were so drawn that none of their contents were spilled inside the body, the bird kept better than in the undrawn state. The work of the Bureau of Chemistry on this subject is referred to later.

It is greatly to the housekeeper's advantage to buy fresh, well-drawn poultry, for not only is the flavor injured by the unclean practice of allowing the entrails to remain in the body, but it is thought to favor the development of ptomaines. It has been shown that after death the intestinal juices with their contained bacteria are able to pass through the walls of the intestines into the muscle fiber, and this process goes on even though the fowl is kept at a very low temperature. In some States cold-storage fowls are required by law to be sold as such.

[1] Mass. State Bd. Health Rpt., 39 (1907), pp. 265, 287.

Fish

Regarding fish, one quality is so all-important that the buyer is warranted in giving the order: "Any kind that is fresh." The dealer knows what he is selling. The buyer may not be able to discover from lack of experience in the effect of ice and cold storage. It is safe to rely on a good dealer if the buyer is a good judge of fish when it comes on the table and then holds the dealer strictly to account. Fish that has been kept for a week or more on ice has lost its distinctive flavor, although it may not be spoiled. It has what the cook calls a "woolly" taste. Shellfish form a delicious addition to the diet, but if they have been grown or fattened in sewage-infected water they may carry disease germs. As it is in general impossible to learn their origin, the rule of never eating them in the raw state is adopted by many. The practice of fattening or "floating" oysters in fresh or in brackish water robs them of much of their fine flavor, and since the most accessible supply of such water is at the outlet of streams, and as such streams are frequently polluted by sewage, many persons believe that this practice should be forbidden by law.

In many European cities fish are sold alive, the customer selecting his fish as it swims in a tank. It would seem that this excellent method might be used in our own cities, especially those situated on the seaboard, at least for customers who are fastidious and who are willing to pay an extra price for special articles when it is warranted.

Vegetables

Only those who have been accustomed to eating green vegetables fresh from the garden realize in what poor condition are many of the vegetables sold to the city

buyer. Some varieties, as green peas, are so delicate in flavor that even a few hours' removal from the vines brings about a change. Indeed, the market gardener has been obliged to develop the keeping qualities of vegetables and fruit at the expense of flavor.

If lightly packed and transported only a short distance, the deterioration in most vegetables is not noticeable, but if closely packed for any length of time changes due to the action of enzyms or "ferments" normally present in the living tissue take place, with a consequent loss of flavor.

In green corn, for example, the ferments present begin immediately to destroy the contained sugar, and thus the corn is robbed of flavor very shortly after picking. These changes are often accompanied by changes in appearance by which they may be detected, especially in green corn and in peas and beans. Pods inclosing peas should be crisp and plump. String beans should not have a faded look or any suspicion of toughness or limpness when broken. Green corn should show fresh husks or "shucks" of good color, not wilted or partly dry, nor lacking the "bright" look of the fresh ear. Cabbages should be crisp and bright of color. Cucumbers, turnips, and carrots should be firm to the touch. Lettuce, if of the headed variety, should have firm, bleached hearts, showing no trace of the rusty red look that announces long keeping. It will keep its freshness longer if the root is left on.

Some market men and grocers grow part or all of their own vegetables, and make a practice of having only fresh ones of good quality in stock, though the combination of market gardener and grocer is, in the nature of things, not common. A much larger number of

market men and grocers are very particular to procure for sale only fresh vegetables, and here again the discriminating buyer will patronize the dealer who is to be trusted.

When housekeepers buy vegetables of peddlers, they should patronize, if possible, the grower rather than the huckster. The grower must sell out and go home, and it is to the huckster that he sells his surplus, and this surplus is often so manipulated as to sell for fresh goods until the next market day. The huckster in his off hours may often be seen trimming off the wilted outside leaves of celery, cabbage, and lettuce and giving a fresh surface to the stem, and sometimes rinsing or sprinkling the lettuce with water not infrequently far from clean. The beets which were left over, after losing little by little their tops, are sold by measure to whoever will buy.

It may be said in general that when a given vegetable is cheapest then it is best, for all conditions are then favorable to its development. Potatoes should be bought in a fully ripened state, not too young, nor is it necessary to eat them when they have become too old, as it is easy to find substitutes such as boiled rice, hominy, and similar foods.

Veget bles of medium size, neither very large nor very small, will be generally found to be the best, and most housekeepers consider them the most economical, as they may be cooked and served with least waste.

The Storage of Food

In earlier times a larger proportion of the food was stored at home than is now the case. Even in cities and towns supplies were commonly purchased in bulk. Owing to the improvement in transportation facilities

and to other changed conditions storage of food outside the home has developed into an enormous industry. As was the case with markets and food manufactories the storage plant is a matter in which the housewife is interested, as it has to do with the character of the food which comes into the home.

Commercial Cold Storage

Cold storage as applied to whole carcasses of beef and mutton has been of great service to the buyer. By its aid prices are equalized and we are furnished even in summer with meat that has been made tender by keeping.

The service rendered by cold storage of fish and poultry is not so thoroughly well established. The subject is being carefully investigated by experts. Apparently, if the process is carried out in the best manner and the goods not kept too long in storage, the cold-storage fish and poultry are wholesome. From the results of an investigation of the quality, flavor, and wholesomeness of cold-storage turkeys, drawn and undrawn, the changes brought about by storage, and similar matters carried on for the Buffalo, N. Y., Department of Health,[1] the conclusion was drawn that under proper regulation cold storage can be safely employed for poultry, but that regulation is essential. The question of the effects of cold storage on the character of meat and other food products, the comparative merits of drawn and undrawn poultry, and similar matters are being investigated by the Bureau of Chemistry of this Department and are discussed in its publications.[2]

[1] Buffalo [Dept. Health] Sanit. Bul., n. ser., 2 (1909), No. 3, p. 1.
[2] U. S. Dept. Agr. Yearbook, 1907, p. 197; Bur. Chem. Bul., 115.

With all cold storage foods it is important that there shall not be a long interval between removal from storage and cooking, and this is particularly the case with poultry and fish. Foods that have been frozen and then thawed seem to furnish particularly good ground for bacterial growth, or what we call "spoiling."

Storage of fruits and vegetables, which is coming more and more into use, gives us many out-of-season articles. The same is true to a great extent of turkeys and other domestic poultry, for food of this kind is largely of seasonal production, and cold storage seems to be the only method by which the fresh material can be kept for a long period for market purposes. In the case of many sorts of cold-storage fruits and vegetables it is the common opinion that their quality is hardly as good as that of fresh ones. On the other hand, if handled under the best conditions much of the cold-storage goods, such as apples and other fruits, is of excellent quality. Indeed, it is difficult to imagine how housekeeping could be carried on, particularly in large cities and towns under modern conditions of home construction (with limited storeroom, etc.) without the cold-storage industry. For this reason it is all the more important that the housewife should be informed as to the best ways to handle such commodities, and should use her influence to insure the best conditions in the cold-storage industry.

The Storeroom in the Home

The storeroom for food may be the tiny closet of the flat dweller in a city or the cellar of the village or farm house. In the last case it often has a commercial as well as a household value, since it keeps fruits and

vegetables in good condition until marketed, as well as until they are needed for the home table; but in any case, it should be cool, dry, clean, and regularly aired.

It may be well to describe a cellar that is badly built and carelessly kept, in order to see what should be exactly opposite conditions.

Such a cellar may be dug in wet ground, without sufficient drainage of the subsoil; it may even be in contact with open sewers or drains, which have been proved in certain cases to contain specific organisms capable of producing disease. In many cases the cellar built against an earth wall is not protected from dampness by a layer of moisture-proof cement, and the water may stand in drops on its surface. Again, it may be dug to such an extent below the surface of the ground that the windows are wholly inadequate for lighting and ventilation.

It may have an earthen floor, or one of badly matched boards impossible to keep clean. It will probably have a musty smell, proof positive that mold plants are there and ready to attack any fruit and vegetables stored on its shelves or in its dirty bins.

If, in addition to this faulty construction, the cellar is badly kept, bits of rotting fruit and vegetables being left about, not only will these conditions favor the spoiling of food, but they may prove injurious to the health of the family living above stairs.

A cellar that meets modern requirements must be dug in ground that is well drained either naturally or by artificial means. It must be remembered that a cellar is not, first of all, a storeroom; it is an essential part of a well-planned house, especially necessary in our Northern States, in helping to keep an equable temperature; and if its walls and floor are what they should

be it prevents dampness and ground air from rising into the house.

If the house is set close to the ground the cellar windows must be wide enough to compensate for their lack in height, and must be set opposite each other in order to insure good draft. A method that is sometimes used is to dig out a space in front of a window, making a little area which, laid in either brick or stone, may be whitewashed and reflect light into the cellar. This method also allows of sinking the cellar window deeper and obtaining better ventilation.

This matter and related topics are considered in a recent volume [1] on farm home construction and similar questions.

The walls and floor of this cellar should be laid in Portland cement to keep out moisture, and the walls and ceiling should be whitewashed twice a year. Even if a cellar is kept very clean, the earthy smell of vegetables that arises from it when it is well stocked is not agreeable—another reason for good ventilation and frequent airing. A separate room may be partitioned off from the cellar in one corner for storage purposes. This can then be kept darker than one would wish to keep the rest of the cellar. Such a room must, of course, be aired now and then. In this storage room should be placed a movable safe with wire-netting sides, and a swinging shelf; and broad shelves should be built high enough so that barrels may be shoved under them.

The writer once saw in Holland a cellar that met every possible requirement of hygiene. The floor and side walls were of closely matched tiles laid in cement, making it as tight as a dish and as easily cleaned.

[1] The Healthful Farmhouse. Boston, 1906.

It was not large, but its wall space was so utilized that it furnished ample storage facilities for a large restaurant.

Hot-weather Storage

The storage of food in cold weather is a comparatively simple matter, since the low temperature, which is a prime requisite for checking the growth of bacteria and molds, is furnished by nature and we have only to guard against freezing. The keeping of perishable foods in warm weather is best accomplished by artificially cooled air.

Ice Machine

On a large dairy farm or wherever the household is large enough to warrant it an ice machine may be used which is driven by an electric motor of suitable horsepower, or by a gas or some other suitable engine, which operates a brine tank and furnishes very cold dry air to the ice chest. Such clean, dry air at a constant low temperature furnished from outside is so superior a method of cooling food that the ordinary ice chest seems a poor thing in comparison, though in the majority of homes it is the only resort.

Ice Chests

There are many varieties of ice chest or refrigerator, all built on one of two general plans. In one kind both ice and food are kept in one large compartment. In the other the ice is placed in a top compartment, below which are cupboards for the food; the principle here utilized is that cold air seeks a lower level and that the air cooled by the melting ice will sink to the shelves below. It probably better utilizes a given amount of ice, for the further reason that the ice compartment

may remain tightly closed except when being filled. In both cases the air space between the outside wall and the zinc lining is filled with some nonconducting material, as cork or asbestos.

It is of great convenience to have the ice chest built against the outer wall of kitchen or pantry, so that it may be filled from the outside by means of a small door cut for that purpose. In such a case it is of course advisable to choose a wall on which there is little or no sunshine. The ice box may also be drained by a pipe leading to the outside and then properly cared for, thus saving much labor in the emptying of pans. It is not considered safe to connect it with the house sewer because of the danger of sewer gases "backing" into it, even if a good trap is provided.

Care of Ice Chests

If on a warm summer day you put your hand into an ice box well filled with ice you may think that the temperature is very low, and yet it is in all probability nearer 50° than 40° F. As low a temperature as 40° or 45° is only to be obtained in a very well-constructed box with a large receptacle for ice, and then only for a short time after it is filled. A box that maintains but 60° is, however, very useful in keeping food from day to day.

The ice box, no matter how well cooled, is and must be damp, and dampness is one of the requirements for bacterial growth. It must be remembered, also, that some varieties of bacteria grow at low temperatures. Therefore the interior of an ice chest should be wiped every day with a dry cloth and once a week everything should be removed, so that sides, shelves, and drain may be thoroughly scalded. The water must be

actually boiling when it is poured in, and the process repeated several times.

In the small ice chests, where all the ice space must be utilized, the cube of ice will be a tight fit, and it is difficult to lower it to the grating. If the ice is put on a piece of stout cloth whose ends are long enough to reach above the top, it may be lifted by these ends and easily deposited in place. The cloth folded about it serves also to protect the ice from the heat of the outside air, and holds any bits of dirt that may have been frozen into the ice, thus preventing them from settling to the floor of the box or lodging in the drain pipe. The cloth should be scalded after each using. A folded newspaper laid on the floor of the one-compartment ice box serves the same purpose as to cleanliness. It must be remembered that refrigerator ice is often dirty, and that it may bring in putrefactive or even typhoid bacilli, for most bacteria are resistant to low temperature and are not destroyed by freezing. On this account no food should be brought into direct contact with it, nor should it be put into drinking water, unless its purity is above suspicion.

All cooked food should be cooled as soon as possible before being placed in the ice box. Butter may be kept from taking up the flavors of other food by keeping it in a tightly covered receptacle. Milk requires more access of air, but in a clean ice box in which no strong-smelling food is kept milk should remain uninjured in flavor for 12 to 24 hours. If vegetables or other foods of pronounced odor are kept in glass jars with covers or in covered earthenware receptacles there will be fewer odors to be communicated. Portions of canned food should never be put into the ice box in the tin can. Such food does

not of necessity develop a poisonous product, as has sometimes been claimed, but experiments show that ptomaines are particularly liable to develop in such cases. Casting out this somewhat remote possibility, the " tinny " taste acquired by such keeping is enough to condemn the practice.

Foods that are to be eaten raw, such as lettuce and celery, should be carefully cleaned before being placed in the ice box, and may with advantage be wrapped in a clean, damp cloth. If they are to be kept for some days they should, however, be put in without removing the roots, the further precaution being taken to wrap them carefully in clean paper or to put them into grocers' bags.

Water for Cooling Food

There are many ways of lowering temperature by utilizing the fact that water when evaporating draws off heat from surrounding objects. If a pitcher of water be wrapped with a cloth which is kept saturated and exposed to a draft of air the temperature of the water in the pitcher will be lowered by several degrees.

A receptacle in which food is placed may be cooled in the same way. Take a wooden box with a sound bottom made of one piece and invert it. Tack a layer of cotton batting over it and cover with some coarse cloth. It is now to be kept wet by some contrivance that will furnish an automatic drip. The writer used for this purpose an old aluminum pan which had in it a half dozen very tiny holes, and when filled with water it supplied just enough water to keep the cloth saturated. Under this box lettuce in cold water, a cold pudding, a pat of butter, and other food were placed

and kept in good condition. A pan of milk lowered into another of cold water is kept from souring many hours longer than if it was unprotected from the surrounding air. Spring water of low temperature is used by many farmer's wives to keep milk and butter cool, and a " spring house " is a common thing on many farms, though less depended upon than was the case before ice houses, refrigerators and ice chests became so common.

It is also an old-fashioned practice to lower foods in covered pails into the well and suspend them not far above the surface of the water.

Winter Storage of Food

In the Southern States storage problems are not the same as in regions where the winter is severe, and many roots and other vegetables may be left in the ground with little or no protection, while crops may even be grown throughout the year, thus doing away largely with the need of winter storage. In the greater part of the United States, however, the problem of keeping at least a part of the food supply through the cold season is an important one, and the more important the longer the winter season.

The farmer will without question keep in cellar or storeroom or outside cave or pit the surplus of what is raised on the farm. Whether it is wise for others to buy food in large quantities and store it for winter use depends on whether it can be bought at a sufficiently low price to pay for the care and risk that the keeping entails, as well as on market facilities, the amount of storage space available, and similar factors. But the storing of smaller quantities of food is both con-

venient and economical and is an absolute necessity for families who live at a distance from market.

A Window Storage Box

The dweller in a small apartment who has no cool cellar in which to store perishable articles may find an outside window box useful in winter.

A carpenter may be hired to construct a box that will exactly fit outside a kitchen window, if possible on the north side. Such a device has been described in a number of books and bulletins.[1] It should come halfway up the lower sash and contain two deep shelves, and when the sash is raised the contents of these shelves are easily accessible. In freezing weather the sash may be left up, and thus the box becomes a part of the warmed room. A sash curtain will conceal it from the room. Such a window box is often fully as great a convenience in the farm or village home as in the city flat.

A more inexpensive way is to hang a neat wooden box, well cleaned, on strong nails or spikes outside the window. A heavier box may be supported on brackets. The box should have a tight-fitting hinged lid and be lined with asbestos paper to equalize extremes of temperature, while a lining of oilcloth will admit of easy cleaning. A shoe box would be good for this purpose. It might be painted the color of the house.

The Keeping of Vegetables, Fruits, and Meats

The following hints regarding the keeping of different kinds of food may be found useful:

[1] Cornell Reading Course for Farmers' Wives, 1. ser., No. 1, p. 6—Farm House and Garden; No. 3, p. 52—Housekeeping; also Reading Lesson Sup. 1.

Potatoes are kept without difficulty in a cool, dry, and dark place. Sprouts should not be allowed to grow in the spring.

Such roots as carrots, parsnips, and turnips remain plump and fresh if placed in earth or sand-filled boxes on the cellar floor.

Sweet potatoes may be kept until January if cleaned, dried, and packed in chaff so that they will not touch each other.

Pumpkins and squash must be thoroughly ripe and mature to keep well. They should be dried from time to time with a cloth and kept, not on the cellar floor, but on a shelf, and well separated from each other.

Cabbages are to be placed in barrels, with the roots uppermost.

Celery should be neither trimmed nor washed, but packed, heads up, in long, deep boxes, which should then be filled with dry earth.

Tomatoes may be kept until January, if gathered just before frost, wiped dry, and placed on straw-covered racks in the cellar. They should be firm and well grown specimens, not yet beginning to turn. As they ripen they may be taken out for table use, and any soft or decaying ones must be removed.

Apples, if for use during the autumn, may be stored in barrels without further precaution than to look them over now and then to remove decaying ones; but if they are to be kept till late winter or spring they must be of a variety known to keep well and they must be hand-picked and without blemish or bruise. They should be wiped dry and placed with little crowding on shelves in the cellar. As a further precaution they may be wrapped separately in soft paper.

Pears may be kept for a limited time in the same

way, or packed in sawdust or chaff, which absorbs the moisture which might otherwise favor molding.

Oranges and lemons are kept in the same way. Wrapping in soft paper is here essential, as the uncovered skins if bruised offer good feeding ground for mold. Oranges may be kept for a long time in good condition if stored where it is very cold but where freezing is not possible. Lemons and limes are often kept in brine, an old-fashioned household method.

Cranberries, after careful looking over to remove soft ones, are placed in a crock or firkin and covered with water. A plate or round board placed on top and weighted serves to keep the berries under water. The water should be changed once a month.

In winter large pieces of fresh meat may be purchased and hung in the cellar. Thin pieces, as mutton chops, are sometimes dipped in mutton suet, which keeps the surface from drying and is easily scraped off before cooking.

Turkeys, chickens, and other birds should be carefully drawn as soon as killed and without washing hung in the coolest available place.

Smoked ham, tongue, beef, and fish are best put in linen bags and hung in the cellar.

Salt pork and corned beef should be kept in brine in suitable jars, kegs, or casks, and should be weighted so as to remain well covered. A plate or board weighted with a clean stone is an old-fashioned and satisfactory device.

Eggs may be packed for winter use in limewater or in water-glass solution, methods which are described in an earlier bulletin [1] of this series. Many housekeepers have good success in packing them in bran,

[1] U. S. Dept. Agr., Farmers' Bul. 128.

in oats, or in dry salt, but according to experiments summarized in the aforementioned bulletin, the preference is to be given to the 10 per cent solution of water glass. Exclusion of the air with its accompanying micro-organisms and the prevention of drying out are what is sought in all cases. Packed eggs are not equal to fresh eggs in flavor, but when they are well packed are of fairly good quality and perfectly wholesome.

Storage of Groceries, Meats, Cooked Food, and Canned Goods

Flour comes packed both in barrels and in bags, and the form in which it shall be purchased and kept is of importance to the housewife. Bags have certain advantages over the barrel for both producer and consumer; they pack into freight cars with no waste of space, and the cloth for 8 bags costs less than one barrel; for the consumer, also, it is often convenient to buy in small quantities. But, on the other hand, the bag is too often very flimsy in texture, so that it allows flour to sift out, and is also easily soiled by contact with a damp or dirty floor. The purchaser may well require that the bags be made of good material, so that the contents may be protected from dust and dirt.

On this question Prof. Harry Snyder, of the University of Minnesota, says:

> There is no question whatever but what flour improves by storage up to 6 months, and it will then hold its own for some time, depending upon the character of the wheat and the thoroughness with which impurities are removed.
>
> As a general proposition it seems certain that it is economical for the consumer to buy flour in bulk rather than in small

sacks at a time. In the fall of the year a small sack of flour for trial purposes can be purchased of the grocer and at the same time he can set aside a barrel of the same flour of the same shipment for future delivery, provided the first sample proves satisfactory. As a general rule the price of flour advances from fall to spring sufficiently, to more than cover the interest item involved and at the same time the consumer is assured of a good quality of flour.

Aside from accidental contamination the chief destructive agencies in stored flour and similar materials are fungi and bacteria. The fungi or molds break down chiefly the starches of the flour, forming organic acids which make the flour sour. The bacterial growths which are present are chiefly forms which liquefy or break down the gluten, the acid presumably aiding in this. This matter has been studied by H. G. Bell,[1] among others, in connection with the problem of commercial storage, and he recommends storage in well-lighted, warm, and dry rooms as a preventive of the development of fungi and bacteria, a method as applicable to farm and town homes as to commercial conditions.

The various prepared or "self-raising" flours are more expensive than the mixture that the housewife can easily make by adding the requisite amount of baking powder to flour and sifting it several times. It is a convenience and a saving of time to keep this mixture on hand, as one sifting provides enough for a month's use in cakes and muffins.

The fact that many breakfast cereals that were once sold only in bulk can be bought in packages is a great advantage from a sanitary point of view. The contents of these packages, if bought fresh and if well cared for, will remain in good condition for months. If made in

[1] Oper. Miller, 13 (1908), p. 591; Amer. Miller, 37 (1909), p. 280.

clean factories, such goods have had little chance for contamination from dust and dirt.

If breakfast cereals are brought in bulk they should be kept in tight receptacles in a cool, dry place. Crackers may be kept like breakfast cereals, either in the packages, in which many sorts are marketed, or in tin boxes or in jars.

Corn meal spoils more readily than flour, and for most families it is best to buy in small quantities.

Rice, tapioca, macaroni, and similar dry materials may be kept without any trouble in covered cans or small crocks in a dry, clean place. The same method is advisable for raisins, Zante currants, evaporated and dried fruits, and similar supplies.

Sugar and salt are best kept, the former in tin, the latter in wooden or crockery receptacles.

Glass preserve jars are perhaps the best and most convenient of all containers for small quantities of almost any food material.

Bread and Other Cooked Foods

While cooling, newly baked bread should be lightly covered with a clean cloth or paper to prevent mold germs and dust from falling upon it, but should not be tightly wrapped in a thick cloth as is the practice in some households, for unless it is aired when taken from the oven, it is likely to become "soggy" and damp and thus offers an excellent medium for cultivation of molds. When perfectly cold the bread should be placed in a close receptacle that has been thoroughly scalded and aired. If bread is to be kept for more than 2 or 3 days in damp, hot weather, the jar or box should be taken out and sunned for a short time now and then, and again scalded and dried.

On no account should portions of a former baking be stored with a new batch.

Cake and cookies should be cooled after baking and kept in tin boxes or in earthenware jars, which, like bread boxes, should be often scalded and aired. Even if these foods are to be eaten at the next meal it is well to keep them in some such receptacle, as it insures protection from dust. A cake, pudding, or pie put out of a window uncovered to cool or in any other place where it is exposed to dust, and in summer also to flies, is something that no careful housewife would place on her table if she stopped to think how easily the food may be contaminated.

Canned Fruits and Other Canned Goods

Commercial canned goods may be advantageously bought by the dozen in the autumn, and they do not seem to suffer from even a poor storage place, provided it is not so damp that the cans rust through. If dirty or dusty, the cans should always be carefully wiped before they are opened to prevent accidental soiling of the contents.

Vegetables and fruits canned at home and home-made jellies, jams, and similar foods should be kept in dry, airy storage places, out of direct light. The cans and jars used should be of good quality, and all the usual precautions of good rubber rings (if they are used), and so on, should be taken. These matters are discussed in earlier bulletins [1] of this series.

Canning may also be made use of daily for temporary preservation of food, and it is especially valuable where ice-chest facilities are not good. When making soup stock a large quantity is made as easily

[1] U. S. Dept. Agr., Farmers' Buls. 203 and 359.

as a small, and the surplus may be poured, while hot, into fruit jars and sealed. Boiled milk may be thus canned and cooked vegetables which may be at the time plentiful or cheap. Mince meat may also be canned, but it will keep a long time in an ordinary receptacle if melted suet be poured over the top.

Such canning, especially of soup stock or milk, is only recommended for a few days' keeping, and every precaution should be taken that is familiar in the ordinary canning of fruit or vegetables.

Labeling Foods in Packages and Cans

Many otherwise good housekeepers are very indifferent about labeling. They trust to their memory as to what is in each jar or package, and sometimes with disastrous results. All stores should be plainly labeled.

Care and Utilization of Fats

Fats that are derived from the cooking of bacon, ham, chicken, beef, and other meats, should be kept, each in its own receptacle, to be used for different purposes.

Home rendering of both suet and leaf lard has its advantages, because the product is generally superior to what can be bought for the same price.

Both suet and leaf lard require cooking in order to loosen the fat from the tougher membrane that holds it. For this purpose the material is cut in small pieces and covered with water and allowed to cook slowly for some time until no more water remains and the scrap has turned to a light brown.

A better method for suet is that used by German housewives, who economize on butter by the use of beef fat more than do American housekeepers. The

suet is cut in small pieces and covered with water, in which it is allowed to soak for a day, the water being changed once in the time. It is then drained and put into an iron kettle with one-half teacup of skim milk to every pound of the suet. It should be cooked very slowly until the sound of boiling entirely ceases. When it has partly cooled, it should be carefully poured off. This fat has no unpleasant taste or odor, and in many recipes may be substituted for part of the butter. Some cooks add a pound of leaf lard to 4 or 5 of the suet; this makes a softer fat, as lard has a lower melting point than beef fat.

An old-fashioned method of clarifying fat from the soup kettle, or from cooked meats, so that it may be used in the kitchen, is to add the cold fat to a liberal quantity of cold water, then heat slowly and let cook for an hour or more. When cold, the cake of fat is removed and the lower portion, which will contain the small particles of meat, etc., should be scraped away and the white, clean fat saved. If the flavor or color or both are not satisfactory the process may be repeated several times. Another method which is often recommended is to cook a number of slices of raw potato in the boiling fat.

When an ice chest is used fat in small quantities may be easily kept sweet for cooking purposes. If lard is rendered at home in quantity sufficient for a long time, it should be kept covered in tins or earthen jars, in a cool, dry place, as in a cellar or storeroom.

In some families where fat from cooked meats is not used in the kitchen it is made into soap for laundry or even toilet use. Directions for making soap at home may be found in most good books on housekeeping. Some questions concerned with soap making

at home are considered in a discussion of laundry and other cleaning problems by Miss Rose,[1] of the Home Economics Department of the Agricultural College at Cornell University.

Cooking butter may be bought at a lower price than table butter, but it should be rendered before using. It may be found to have some degree of rancidity, and to correct this condition there must be mixed with it $\frac{1}{4}$ to 1 teaspoonful of baking soda to the pound. It should be melted and cooked down slowly until the froth rises and the sound of cooking ceases, then skimmed and poured off carefully from the dregs. Unless to be used immediately, $\frac{1}{2}$ tablespoonful of salt per pound should be added. One-third less of this clarified butter is equivalent to the quantity of ordinary butter called for in any recipe. In India and some other tropical countries this rendered butter, called " ghee " or some other special name, is a product much used by the native population, and through their example by others, who have found by long experience that butter will keep in good condition in this form while it would generally spoil if stored as made.

Handling of Food and Utensils in the Kitchen

The handling of food before it reaches the home is a matter of the greatest importance to the housekeeper, as it has a very important relation to the condition of the food and to its keeping qualities, wholesomeness, and other characteristics after it is purchased.

In preceding sections it has been shown what are the dangers from market dirt and dust, from flies, and other animal life, from the soiled hands and garments and

[1] The Laundry: Cornell Reading Courses for Farmers' Wives, n. s. 1, Sanitation.

utensils of butcher and grocer, milkman, and delivery boy. It is not too much to say that when the food reaches our door much of it is an object of suspicion, and this will be the case until market inspection is far better than at present. But we have now to consider what treatment shall be given to perishable food when it comes into the kitchen.

Meats

The dealer must be especially enjoined to tie up the meat in a secure package, else the brown paper in which it is loosely wrapped will not protect it thoroughly in transit. This paper should not go with the meat into the ice box.

When meat is received the skin side should be rubbed with a cloth wet in hot water and then carefully scraped with a knife. The thin outer skin of lamb should be entirely removed in order to avoid the disagreeable taste due to any contact with the hair of the animal. The cut surface should also be carefully scraped, and, to prevent drying, be covered with paraffin paper or rubbed with salad oil, or, in case the meat is to be kept for some time, entirely covered with melted suet. The meat should then be put on a plate in the ice box.

Poultry

The skin of poultry is frequently very dirty when brought from market and fowls should be not only washed, but scrubbed with a soft brush and warm water in which a teaspoonful of baking soda has been dissolved. Such treatment will prevent the disagreeable "henny" taste often noticeable in cooked poultry.

Poultry should be drawn immediately, and unless it is known to have been killed very recently it should be thoroughly washed on the inside and used soon. Poultry that is drawn directly after killing, on the contrary, keeps better if it is not washed until used. It should be hung in a cold place or put in the ice box with a piece of charcoal inside the body.

Cold-storage chickens should under no circumstances remain in a warm room before cooking. Such poultry must be kept at a low temperature and cooked as soon as possible. All cold-storage food when brought into a warm temperature spoils quickly, and without doubt many cases of illness traced to the use of such food are really due to careless handling and delay in cooking.

Washing Vegetables

If deteriorated vegetables are brought into the kitchen no method of handling will restore them to first-class condition. Even good ones will not be at their best unless they are properly cared for after being received. After all that has been said in this bulletin regarding the possibilities of dangerous micro-organisms having lodged upon vegetables, it may seem superfluous to insist again that any which are to be eaten raw should be thoroughly washed. It is of course useless to wash them with water which is itself dangerous, and in any case where the water supply is not considered safe for drinking, boiled water should be used for washing vegetables and fruit after the first rough dirt has been removed by hydrant water.

As to the method of washing vegetables, a few cautions are in order. Some people never choose asparagus at table unless it has been prepared by some one

who is very careful, as they do not wish to bite down on sand, for the cleaning of this vegetable requires conscience as well as care. The bunch should be placed, heads down, in water for some hours and should be shaken back and forth to dislodge the particles of earth. Spinach is another vegetable which requires the best cleansing to free it from grit. After the roots have been cut off it should be washed in a number of waters and lifted out of the pan each time in loose handfuls before the water has been drained off.

Celery and lettuce and other salad plants, because eaten raw, must be washed with the greatest care. They should be searched leaf by leaf for insect life, washed in several waters, and then wiped dry with a clean cloth and put in a cold place to become crisp.

Washing Fruits

A German investigator, B. Ehrlich,[1] having estimated by careful experiments the number of bacteria to be found on market fruit, tried different methods of washing it without injuring the flavor. He washed grapes, apples, and pears that had been exposed to street dust, each time examining the wash water for the number of bacteria present. While the first wash water yielded large numbers, the second contained only a few, and the third a negligible number. A basin of water was used for the purpose, the fruit being moved about in it. When running water was used, five minutes' time was allowed. Fruits with a firm, smooth skin should be rubbed before washing with a clean cloth to start the dirt.

The cleaning of delicate berries is a difficult matter. Such fruit should be purchased with care to avoid all

[1] Arch. Hyg., 41 (1901), p. 152.

that are too soft or which show sand or other visible dirt. Strawberries, because they grow so near the ground, should not be purchased after a rain, which will spatter them with muddy drops. Only the freshest and cleanest berries should be served raw; more doubtful specimens should be cooked. By immersing them in water a few at a time and handling carefully, such fruits may be washed without much loss of flavor. These matters are also discussed in an earlier bulletin [1] of this series.

Dried figs and dates are very commonly eaten without cooking, or even washing, and yet they have been exposed for an unknown length of time to the contagion brought by dust, flies, and dirty hands. In how many houses are oranges washed before they are brought to the table, or the lemon before it is sliced for the tea or lemonade, or before the skin is grated for flavoring? Yet the skin is often very dirty.

Shelled nuts purchased in market should always be washed and scalded before they are used, as they are commonly exposed to dust, and perhaps to flies. They can afterwards be dried on a clean cloth before using.

Many careful housewives wash nuts in the shell before cracking, as this prevents accidental soiling of the kernels.

Washing Eggs

The ordinary way to break an egg is to hit it against another egg or over the edge of the mixing bowl and let the contents stream over the side of the shell without considering whether the latter is clean or not. Even if there is no visible dirt, the shell may not be as

[1] U. S. Dept. Agr., Farmers' Bul. 293.

clean as it seems, for it may have come from a dirty nest or have been untidily handled. Eggs should therefore always be washed before breaking.

Dishwashing

The bacteriologist finds no kitchen clean enough and the ordinary methods of washing dishes he is likely to call a "smear."

Dishes have been tested to determine the number of organisms that remain on them after "ordinary" washing as compared with a method that requires an application of hot water with the help of soap, or better still, carbonate of soda, a thorough rinsing in hot water, and wiping with a sterilized cloth (that is, one which has been in boiling water since it was used before). By this latter method the dishes were practically sterile while many organisms were left on the dishes that were washed by the "ordinary" method.

One might ask what harm they will do if present. Oftentimes none, but if the bacteria are those which convey disease, dirty dishes may be the means of giving it to well persons. But most of all, persons who are at all thoughtful of such things do not want any dirt which may be prevented by good methods, simply because dirt in itself is sufficiently unpleasant.

In washing milk utensils it is first necessary to remove with warm water all traces of the milk before scalding water is used. Because of the cream adhering to the sides soap is used also, but the greatest care must be taken to remove by repeated rinsing every trace of soap. A telltale flavor of soap in the morning cream has more than once revealed careless habits in the kitchen, and made it evident that all the soap was not

removed in rinsing. The utensils must then be dipped into absolutely boiling water for a moment.

It is an important matter to wash the milk bottle in which milk is now commonly delivered to customers. By this we refer to the washing of the full bottle before it is opened. It is safe to say that this is seldom done. But notice the bottle as it is brought into the kitchen, the milkman grasping it with his hand over the top. These hands perhaps more often than not have harnessed his horse, have been grasping the reins all the morning, have opened and shut doors, run along stair railings, have perhaps wiped mouth or nose, and yet the thoughtless housekeeper or cook, regarding the white cap as full security from the outer world, pours out the milk over a very dirty bottle brim. Milk bottles should be put under the hot water spigot for a moment and wiped dry with a clean cloth before opening. Most housewives agree that milk bottles should be carefully rinsed before they are returned, perhaps more from a feeling for cleanliness than for absolute necessity, as the milk bottles in all well-managed dairies are thoroughly scrubbed and washed before refilling. If such violations of this practice as recently came under observation are noted, when the driver of a dairy wagon washed out some milk bottles in a public drinking fountain provided for horses, refilled them, and disposed of them to other customers, complaint should be made to the dairy, and if this is not sufficient, to the board of health.

Care of the Water Cooler

Water is an indispensable food adjunct and so may be properly spoken of here. The water and the ice supply should both be above suspicion. The question

of wells, water, and ice supply has been discussed in earlier bulletins of this series.[1] The greatest care should be taken to keep clean and in good condition all vessels in which water is used for household purposes. Water coolers, if used, should be of some material like porcelain or enameled ware which is easily kept clean. They should be scalded out at frequent intervals. The ice, if it comes in contact with the water, should be of known quality. If such ice can not be secured, a water cooler should be used in which the ice is in a separate receptacle and does not come in contact with the water. Many families cool drinking water by putting it in the ice box in glass fruit jars or bottles. Perfect clearness is an indication of purity in ice. Cloudy ice full of bubbles or snow ice should not be used in direct contact with food, and ice which contains dirt of various kinds frozen in it should be regarded with suspicion.

If it is believed that the water is not pure, it may be boiled or filtered, or both. If filters are used, every precaution should be taken to keep them clean and in good condition and to rely only on such as really purify the water. Earthenware filters may be sterilized by placing in a pan or kettle of water and boiling them out after they have been thoroughly scrubbed with a brush. A small piece of wood should be placed under the jar to prevent direct contact with the bottom of the pan.

The water cooler in public places should always be in charge of a responsible person who will keep it clean and in good condition. Some sort of a sanitary drinking fountain is desirable. The public drinking cup of the sort usually seen should not be permitted.

[1] U. S. Dept. Agr., Farmers' Buls. 43, 73, 262, 309.

It is uncleanly and furnishes a ready means of transmitting disease.

Recent experiments made by the Kansas State Board of Health[1] give results which are in accord with the work of other investigators and plainly showed the presence of mouth bacteria and other micro-organisms, including those which cause pneumonia, on drinking cups from an office building, a ward school, and a railroad station. This means that the user of the public drinking cup runs the risk of taking into his mouth more or less of the saliva of some other person and may take with it micro-organisms causing virulent disease as well as the ordinary mouth bacteria which are doubtless harmless. These unpleasant and dangerous features may be avoided by the use of proper drinking fountains and cups.

In many homes a glass or cup is placed by the water pail or water cooler and is used by all the members of the family. Such a custom should not be followed. Although it is necessarily less dangerous than the public drinking cup, it is not a cleanly practice and is many times without doubt responsible for the spread of colds and other minor ailments throughout a family.

Personal Cleanliness in the Kitchen

There may sometimes be observed in the cooked dish a loss of flavor, not a bad taste, but a lack of what is appetizing. It would be interesting to know in how many cases this comes from a lack of cleanliness in utensils and methods.

Personal cleanliness is of course essential in the kitchen, and every good housekeeper endeavors to maintain a high standard in such matters. Some food

[1] Bul. Kans. Bd. Health, 5 (1909), No. 3, p. 76.

manufactories make special efforts to secure cleanliness and hygienic surroundings, and the good example they set should be generally followed.

"Food and fingers are carriers of contagion." The proper way of washing the hands, if seriously taught and seriously practiced, in the market and in the kitchen, would go far to remove the source not only of infection but of such additions to the food as are disgusting to think of. In this matter some food manufactories are cleaner in their methods than are our kitchens. In one large bakery, where information was collected, the rule is in force that every employee shall wash his hands on returning to the room after leaving it for any purpose whatever.

The running tap, like the shower bath, offers a great improvement over old methods of washing. Few will have patience to fill and refill the hand basin until the hands are bathed at last in clean water, but this result is easily accomplished under the tap. The nailbrush and nail cleaner must have their place in the kitchen, and their use must be insisted on before bread or cake is mixed and after work at all soiling in character.

Every one will admit that there is need for exercising great care in coughing and sneezing wherever such necessary acts may be annoying to others. When one recalls that experiment has shown that a fine spray of saliva may be thrown in all directions for a distance of 4 or 5 feet by a violent sneeze or cough and that often the cause of the cough or sneeze is something which can be thus communicated to others, it is evident that there is abundant reason for caution. Particularly is this essential wherever food is prepared, exposed, or served.

Use of Paper in the Kitchen

Paper has many uses in the kitchen. The cook needs a piece of paper on which to drain the fried croquette or fritter, and she reaches out for the brown paper that came around the meat or for the grocer's bag. She turns to the same source when she wishes paper for lining a cake pan. A little reflection will show how far from cleanly is this practice.

In every kitchen should be found a roll of grocer's paper on its frame. You are sure here of something that has not been handled since it was rolled up by machinery in the factory. Paraffin paper should also be at hand for covering food, for wrapping up sandwiches for school lunches, and for similar purposes.

Importance of Good House Plans and Home Conveniences

The care of food in the home and all other forms of household work are greatly facilitated by right planning and the use of suitable materials for the construction and furnishing of the home. An adequate and convenient water supply and other conveniences are essential, not only for comfort and for saving labor, but also from the standpoint of home hygiene. The question of home conveniences, the arrangement of a kitchen, and similar topics are considered in other bulletins [1] of this series and in many volumes on the house and house construction.[2]

Cleanliness in Public Eating Places

The sanitary condition of kitchens and the food service in hotels and other places where food is served

[1] U. S. Dept. Agr., Farmers' Buls. 270, 317, 342.

[2] The Healthful Farmhouse. Boston, 1906. The House, Its Plan, Decoration, and Care. Isabel Bevier. Chicago, 1907.

to the public is a matter to which most persons who patronize them have given at least occasional thought.

Perhaps the most common attitude toward this subject of the "temporary home," as toward markets and other places where food is handled or prepared before it reaches the home kitchen, is that it is least disturbing to put it out of mind and to forget unpleasant things which, it is assumed, can not be remedied.

This is not the right attitude, for the subject has a direct relation to comfort and to health and is one in which public sentiment is perhaps the chief factor in securing regulation. Legislation regarding the inspection and regulation of hotels, restaurants, and other places where meals are served is in force in some cities and contemplated in others. The results of the inspection of restaurant and lunch-room kitchens in Washington, D. C., by the board of health indicates that the matter is one which needs to be under control, and concerning which the public has a right to full information, so that the clean places may be patronized and the others avoided.

Proper ventilation in hotel and restaurant kitchens, suitable sanitary conveniences for employees, and whatever else makes for clean food are matters of public hygiene which are of the same importance as is the case with bakeries, markets, candy factories, and other places where food is handled.

There are other matters which are also worth considering in this connection.

It is no very uncommon thing to notice in a hotel, restaurant, or dining car, and often in those which pride themselves on the excellence of their service, practices which would not be permitted if due attention was paid to all matters of hygiene. For instance,

it may be sometimes noted that finger bowls which have not been washed since a previous service are placed before guests. Soiled napkins may also be seen occasionally in use for wiping off table dishes before service. It is certain that such practices where they exist would not continue if supervision by the management was as thorough as it should be or if patrons were not indifferent to them or lacking in observation.

The public owes a duty to the management in such matters and all such violations of the laws of hygiene and cleanliness should be reported to the proper person. Here, as in most other instances, the remedy lies in the hands of the public.

On the other hand, there is no ground for a general suspicion of the methods in use in hotels and restaurants. Probably in the majority of cases a great deal of attention is given to kitchen and serving-room equipment, which is designed as regards both material and method of construction in such a way that it may be readily kept clean, and good hotels and restaurants are constantly endeavoring to make sure that food is handled, cooked, and served in a cleanly manner. In general, carefully managed hotels welcome inspection of their kitchens and storerooms by visitors.

In conclusion it may be said that the preparation of food must more and more come to be considered as an occupation that requires of the person who undertakes it knowledge and habits quite beyond what is now expected of a person who is simply a "good cook."

It is even more essential that the housewife who buys food and who attends to her own food preparation should have such knowledge.

U. S. DEPARTMENT OF AGRICULTURE FARMERS' BULLETIN NO. 255

THE HOME VEGETABLE GARDEN

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INTRODUCTION

It would be impossible to make an accurate estimate of the value of crops grown in the kitchen gardens of the United States, but from careful observation the statement can safely be made that a well-kept garden will yield a return ten to fifteen times greater than would the same area and location if devoted to general farm crops. A half acre devoted to the various kinds of garden crops will easily supply a family with $100 worth of vegetables during the year, while the average return for farm crops is considerably less than one-tenth of this amount. A bountiful supply of vegetables close at hand where they may be secured at a few moments' notice is of even more importance than the mere money value.

Fresh vegetables from the home garden are not subjected to exposure on the markets or in transportation and are not liable to become infected in any

way. Many of the products of the garden lose their characteristic flavor when not used within a few hours after gathering. By means of the home garden the production of the vegetable supply for the family is directly under control, and in many cases is the only way whereby clean, fresh produce may be secured. The home vegetable garden is worthy of increased attention, and a greater number and variety of crops should be included in the garden.

Suggestions are herein given as to the location of the garden, the soil and its preparation, fertilizers, seeds, and plants, with brief cultural methods for a number of the more important crops.

Location of the Garden

The question of the proximity to the house or other buildings is of great importance when locating the garden. In old homesteads the garden was generally located directly adjacent to the house, requiring but a few steps from the kitchen to reach the extreme parts of the garden. The work of caring for a garden is usually done at spare times, and for this reason alone the location should be near the dwelling. In case the site chosen for the garden should become unsuitable for any cause it is not a difficult matter to change the location. Many persons prefer to plant the garden in a different location every 5 or 6 years.

The lay of the land has considerable influence upon the time that the soil can be worked, and a gentle slope toward the south or southeast is most desirable for the production of early crops. It is an advantage to have protection on the north and northwest by either a hill, a group of trees, evergreens, a hedge, buildings,

a tight board fence, or a stone wall to break the force of the wind.

Good natural drainage of the garden area is of prime importance. The land should have sufficient fall to drain off surplus water during heavy rains, but the fall should not be so great that the soil will be washed. The surface of the garden should not contain depressions in which water will accumulate or stand. Waste water from surrounding land should not flow toward the garden, and the fall below should be such that there will be no danger of flood water backing up. The garden should not be located along the banks of a creek or stream that will be liable to overflow during the growing season.

A good fence around the garden plot is almost indispensable, and it should be a safeguard against all farm animals, including poultry, and should be close enough to keep out rabbits. A tight board fence will accomplish this result and also serve as a wind-break.

Plan and Arrangement of the Garden

It would be difficult to give a plan or specific arrangement for a garden that would suit all demands, and such a plan must be devised by each individual grower. Suggestive arrangements, however, are here presented, with the idea that thay can readily be changed to suit local conditions.

Kind of Cultivation to be Employed

The first consideration in planning the arrangement of a garden is the kind of cultivation that is to be employed. Where the work is to be done mainly by means of horse tools the arrangement should be such as to give the longest possible rows, and straight

	Hotbed.	Cold Frame.	Seed Bed.	
1	Rhubarb.	Horse-radish.	French or Burr Artichokes.	Herbs.
	Gate or Entrance.			
2	Asparagus.			
3	Parsnips.	Carrots.		
4	Salsify and Similar Long-season Crops.			
5	Beets.	Peppers.	Eggplant.	
6	Lettuce (Followed by Celery).	Radishes (Followed by Celery).	Onion Sets (Followed by Celery).	
7		Early Beans (Followed by Celery).		
8	Early Peas (Followed by Celery).			
9	Later Plantings of Peas and Beans (Followed by Spinach and Multiplier or Potato Onions).			
10	Later Plantings of Peas and Beans (Followed by Spinach and Multiplier or Potato Onions).			
11	Later Plantings of Peas and Beans (Followed by Spinach and Multiplier or Potato Onions).			
12	Later Plantings of Peas and Beans (Followed by Spinach and Multiplier or Potato Onions).			
13	Early Cabbage (Followed by Late Peas and Beans).			
14	Early Cabbage (Followed by Late Peas and Beans).			
15	Tomatoes (Plants 4 feet Apart in Row).			
16	Tomatoes (Plants 4 Feet Apart in Row).			
17	Okra, New Zealand Spinach, and Miscellaneous Vegetables.			
18	Cucumbers.	Melons.	Squashes.	
19	Early Potatoes (Followed by	Late Corn or Cabbage, Planted between	Potatoes before Digging).	
20	Early Potatoes (Followed by Late Corn or Cabbage, Planted between Potatoes before Digging).			
21	Early Potatoes (Followed by Late Corn or Cabbage, Planted between Potatoes before Digging).			
22	Early Potatoes (Followed by Late Corn or Cabbage, Planted between Potatoes before Digging).			
23	Early Corn (Followed by Turnips or Rutabagas).			
24	Early Corn (Followed by Turnips or Rutabagas).			
25	Early Corn (Followed by Turnips or Rutabagas).			
26	Early Corn (Followed by Turnips or Rutabagas).			
27	Sweet Potatoes, Jerusalem Artichokes, or Pumpkins.			
28	Sweet Potatoes, Jerusalem Artichokes, or Pumpkins.			
29	Lima and other Pole Beans.			

FIG. 1.—Plan of a half-acre garden. Length 220 feet; width, 100 feet.

		Hotbed.
Lettuce, Radishes, Onions.		
Carrots, Parsnips and All Crops.		
That May be Grown in 18-inch Rows.		
		Cold Frame.
Early Peas and Beans (Followed by Celery).		
Early Peas and Beans (Followed by Celery).	Walk.	
Peas (Followed by Spinach).		
Peas (Followed by Spinach).		Asparagus.
Early Cabbage (Followed by Late Peas).		
Early Cabbage (Followed by Late Peas).		
Tomatoes.		
Tomatoes.		
Tomatoes.		
Cucumbers.		
Cucumbers.		
Cucumbers.		
Muskmelons.		
Muskmelons.		
Early Potatoes (Followed by Late Cabbage).		
Early Potatoes (Followed by Late Cabbage).		Rhubarb and Herbs.
Early Corn (Followed by Turnips).		
Early Corn (Followed by Turnips).		
Early Corn (Followed by Turnips).		
Early Corn (Followed by Turnips).		

Fig. 2.—Plan of a City-lot or Back-yard Garden. 50 by 90 Feet.

outlines should be followed. The garden should be free from paths across the rows, and turning spaces should be provided at the ends. (Fig. 1.) For hand cultivation the arrangement can be quite different, as the garden may be laid off in sections, with transverse walks, and the rows can be much closer for most crops. (Fig. 2.) Horse cultivation is recommended whenever possible, as it very materially lessens the labor and cost of caring for the crops.

Location of Crops

The second matter for consideration is the location of permanent crops, such as asparagus and rhubarb, and if any of the small fruits, such as raspberries, currants, and gooseberries, are to be planted within the garden inclosure, they should be included with the permanent crops. The area devoted to the hotbed, cold frame, and seed bed should be decided upon, but these may be shifted more or less from year to year or located in some convenient place outside of the garden.

Where there is any great variation in the composition of the soil in different parts of the garden it will be advisable to take this into consideration when arranging for the location of the various crops. If a part of the land is low and moist, such crops as celery, onions, and late cucumbers should be placed there. If part of the soil is high, warm, and dry, that is the proper location for early crops and those that need quick, warm soil.

Succession of Crops

In planning the location of the various crops in the garden, due consideration should be given to the matter of succession in order that the land may be occupied

at all times. As a rule it would not be best to have a second planting of the same crop follow the first, but some such arrangement as early peas followed by celery, or early cabbage or potatoes followed by late beans or corn, and similar combinations, are more satisfactory. In the South as many as three crops may be grown one after the other on the same land, but at the extreme north, where the season is short, but one crop can be grown, or possibly two by some such combination as early peas followed by turnips.

Preparation of the Soil

Where there is considerable choice in the location of the garden plot, it is often possible to select land that will require very little special preparation. On the other hand, it may be necessary to take an undesirable soil and bring it into suitable condition, and it is generally surprising to note the change that can be wrought in a single season.

Drainage

There are very few soils that are not improved by some form of drainage. Heavy clay soils are benefited most by drainage, but sandy soils having a clay subsoil are made warmer and greatly improved by having the excess soil water removed quickly.

Plowing

Autumn is the time for plowing hard or stiff clay soils, especially if in a part of the country where freezing takes place, as the action of the frost during the winter will break the soil into fine particles and render it suitable for planting. Sandy loams and soils that

contain a large amount of humus may be plowed in the spring, but the work should be done early in order that the soil may settle before planting. In the Southern States, where there is not sufficient frost to mellow the soil, this process must be accomplished by means of frequent cultivations, in order that the air may act upon the soil particles. It is desirable to plow the garden early, at least a few days sooner than for general field crops.

Sandy soils will bear plowing much earlier than heavy clay soils. The usual test is to squeeze together a handful, and if the soil adheres in a ball it is too wet for working. In the garden greater depth of plowing should be practiced than for ordinary farm crops, as the roots of many of the vegetables go deeply into the soil. Subsoiling will be found advantageous in most cases, as the drainage and general movement of the soil moisture will be improved thereby.

Hand spading should be resorted to only in very small gardens or where it is desirable to prepare a small area very thoroughly.

Smoothing and Pulverizing the Soil

After plowing, the next important step is to smooth and pulverize the soil. If the soil be well prepared before planting, the work of caring for the crops will be very materially lessened. It is not sufficient that the land be smooth and fine on top, but the pulverizing process should extend as deep as the plowing. Some gardeners prefer to thoroughly cut the land with a disk harrow before plowing, so that when it is turned by the plow the bottom soil will be fine and mellow. After the plow the disk or cutting harrow is again brought into play and the pulverizing process com-

pleted. If the soil is a trifle too dry and contains lumps, it may be necessary to use some form of roller or clod crusher to bring it down. For smoothing the surface and filling up depressions a float or drag made from planks or scantlings will be found serviceable.

Special Preparation

For growing certain crops it has often been found advisable to prepare the ground in a special manner. Such crops as beets, radishes, and onions are sometimes grown on beds 6 to 10 feet in width and raised 6 to 8 inches, with narrow walks between.

From Baltimore southward, cabbage, cauliflower, or and similar crops are frequently grown on top on the side of ridges. When the plants are set on top of the ridge, better drainage for the roots is secured. When set on the south side of the ridge, greater warmth and earlier maturity will be secured, and when planted on the north side, the growth is retarded. For growing celery and a few similar crops it has often been found advisable to place the plants in furrows or slight trenches in order that the soil removed may be available for working in around the plants as they mature.

Fertilizers

The kind of fertilizer employed has a marked influence upon the character and quality of the vegetables produced. For the garden only those fertilizers that have been carefully prepared should be used. Fertilizers of organic composition, such as barnyard manure, should have passed through the fermenting stage before being used. The use of night soil generally is not to

be recommended, as its application, unless properly treated for the destruction of disease germs, may prove dangerous to health.

Barnyard Manure

For garden crops there is no fertilizer that will compare with good, well-rotted barnyard manure. In localities where a supply of such manure can not be secured it will be necessary to depend upon commercial fertilizers, but the results are rarely so satisfactory. In selecting manure for the garden, care should be taken that it does not contain any element that will be injurious to the soil. An excess of sawdust or shavings used as bedding will have a tendency to produce sourness in the soil. Chicken, pigeon, and sheep manures rank high as fertilizers, their value being somewhat greater than ordinary barnyard manures, and almost as great as some of the lower grades of commercial fertilizers. The manure from fowls is especially adapted for dropping in the hills or rows of plants.

Commercial Fertilizers

Commercial fertilizers are sold under a guaranteed analysis, and generally at a price consistent with their fertilizing value. No definite rule can be given for the kind or quantity of fertilizer to be applied, as this varies with the crop and the land. At first the only safe procedure is to use a good high-grade fertilizer at the rate of from 1,000 to 2,000 pounds to the acre and note the results. Market gardeners frequently apply as much as 2,500 pounds of high-grade fertilizer per acre each year.

Where plants are not to be transplanted twice, but remain in the plant bed until required for setting in

the garden, it may be necessary to thin them somewhat. This part of the work should be done as soon as the plants are large enough to pull, and before they begin to " draw " or become spindling from crowding.

When thinnnig plants in the plant bed it should be the aim to remove the centers of the thick bunches, leaving the spaces as uniform as possible. When thinning the rows of seedlings in the garden the best plants should be allowed to remain, but due consideration should be given to the matter of proper spacing. Failure to thin plants properly will invariably result in the production of an inferior crop.

Effects of Transplanting

At the North, where the growing season is short, it is necessary to transplant several of the garden crops in order to secure strong plants that will mature within the limits of the growing season. In the Southern States the season is longer, and transplanting, while desirable, may not be necessary, as many crops that must be started indoors at the North can be planted in the garden where they are to remain. Transplanting should be done as soon as the seedlings are large enough to handle, and again when the plants begin to crowd one another.

Aside from producing more uniform and hardy plants, the transplanting process has several other very marked influences. Certain crops which are grown for their straight roots are often injured by having their roots bent or broken in transplanting. On the other hand, such plants as celery, which at first have a straight root and are grown for their tops, are greatly benefited by transplanting. In all cases transplanting has a tendency to increase the number of small roots,

and these are the main dependence of the plant at the time it is set in the open ground.

For further information on this subject, see Farmers' Bulletins Nos. 77 on The Liming of Soils, 192 on Barnyard Manure, and 222, Experiment Station Work, XXVIII, which contains a chapter on the Home Mixing of Fertilizers.

Seeds and Plants for the Garden

The supply of seeds for the garden should be secured some time in advance of the planting season. During the winter months send for the catalogue of some seedsman in your part of the country and make a selection of the kinds and quantities of seeds that you desire to plant. Garden seeds can frequently be secured of some local dealer who handles them in conjunction with other goods. Many of the garden seeds lose their vitality after one year's time, and old seeds should, as a rule, not be relied upon.

Throughout the Northern States it is desirable to start plants of certain crops before the danger of frost has passed. The simplest method of starting a limited number of early plants is by means of a shallow box placed in a south window of the dwelling. After the plants appear, the box should be turned each day to prevent the plants drawing toward the light.

Early Plants in Hotbeds

The most common method of starting early plants in the North is by means of a hotbed. The hotbed consists of an inclosure covered with sash and supplied with some form of heat, usually fermenting stable manure, to keep the plants warm and in a growing

condition. As a rule, the hotbed should not be placed within the garden inclosure, but near some frequently used path or building where it can receive attention without interfering with other work. The hotbed should always face to the south, and the south side of either a dwelling, barn, tight board fence, hedge, or anything affording similar protection, will furnish a good location.

In the North the hotbed should be started in February or early in March, in order that such plants as the tomato and early cabbage may be well grown in time to plant in the open ground. There are two or three forms of hotbeds that are worthy of description, and the plans suggested may be modified to suit local conditions.

A temporary hotbed, such as would ordinarily be employed on the farm, is easily constructed by the use of manure from the horse stable as a means of furnishing the heat. Select a well-drained location, where the bed will be sheltered, shake out the manure into a broad, flat heap, and thoroughly compact it by tramping. The manure heap should be 8 or 9 feet wide, 18 to 24 inches deep when compacted, and of any desired length, according to the number of sash to be employed. The manure for hotbed purposes should contain sufficient litter, such as leaves or straw, to prevent its packing soggy, and should spring slightly when trodden upon.

After the manure has been properly tramped and leveled, the frames to support the sash are placed in position facing toward the south. These frames are generally made to carry 4 standard hotbed sash, and the front board should be 4 to 6 inches lower than the back, in order that water will drain from the glass. Three to five inches of good garden loam or specially

prepared soil is spread evenly over the area inclosed by the frame, the sash put on, and the bed allowed to heat. At first the temperature of the bed will run quite high, but no seeds should be planted until the soil temperature falls to 80° F., which will be in about three days.

Hotbeds having more or less permanence may be so constructed as to be heated either with fermenting manure, a stove, a brick flue, or by means of radiating pipes supplied with steam or hot water from a dwelling or other heating plant. For a permanent bed in which fermenting manure is to supply the heat, a pit 24 to 30 inches in depth should be provided. The sides and ends of the pit may be supported by brick walls or by a lining of 2-inch plank held in place by stakes.

Standard hotbed sash are 3 by 6 feet in size, and are usually constructed of white pine or cypress. As a rule, hotbed sash can be purchased cheaper than they can be made locally, and are on sale by seedsmen and dealers in garden supplies. In the colder parts of the country, in addition to glazed sash either board shutters, straw mats, burlap, or old carpet will be required as a covering during cold nights. It is also desirable to have a supply of straw or loose manure on hand to throw over the bed in case of extremely cold weather.

During bright days the hotbed will heat very quickly from the sunshine on the glass and it will be necessary to ventilate during the early morning by slightly raising the sash on the opposite side from the wind. Care should be taken in ventilating to protect the plants from a draft of cold air. Toward evening the sash should be closed in order that the bed may become sufficiently warm before nightfall.

Hotbeds should be watered on bright days and in the morning only. Watering in the evening or on cloudy days will have a tendency to chill the bed and increase the danger from freezing. After watering, the bed should be well ventilated to dry the foliage of the plants and the surface of the soil, to prevent the plants being lost by damping-off fungus or mildew.

Early Plants in Cold Frames

The construction of cold frames is the same as for temporary hotbeds except that no manure or other heating material is provided. Cold frames are covered by means of ordinary hotbed sash, or cotton cloth may be substituted for the sash. In the North the use of the cold frame is for hardening off plants that have been started in the hotbed, preparatory to setting them in the garden. In the South, where the weather is not so severe, the cold frame is made to take the place of the hotbed in starting early plants. The same methods of handling recommended for a hotbed should apply to a cold frame, and thorough ventilation should be maintained.

The Seed Bed

In the broadest sense the entire garden is a seed bed, as the seeds of many of the crops are planted where they are to grow. As the term "seed bed" is used here it refers to some specially prepared place for starting plants, from which they may be transplanted to their permanent positions in the garden. The location of an outdoor seed bed should be such that it may be conveniently reached for watering, and it should be naturally protected from drying winds.

Good soil for a seed bed consists of one part of well-

rotted manure, two parts of good garden loam or rotted sods, and one part of sharp, fine sand. The manure should be thoroughly rotted, but it should not have been exposed to the weather and the strength leached out of it. The addition of leaf mold or peat will tend to make the soil better adapted for seed-bed purposes. Mix all the ingredients together in a heap, stirring well with a shovel, after which the soil should be sifted and placed in boxes or in the bed ready for sowing the seed.

Weed seeds, and the spores of fungous diseases that are present in the soil for a seed bed, may be killed by placing the soil in pans and baking it for an hour in a hot oven.

Seed Sowing

Garden seeds should always be sown in straight rows, regardless of where the planting is made. If a window box is employed for starting early plants in a dwelling, the soil should be well firmed and then laid off in straight rows about 2 inches apart. The same method holds good for planting seeds in a hotbed, cold frame, or bed in the garden, except that the rows should be farther apart than in the window box. By planting in straight rows the seedlings will be more uniform in size and shape, and thinning and cultivating will be more easily accomplished. In all cases where the soil of the seed bed is not too wet, it should be well firmed or pressed down before laying off and marking for sowing the seeds. After the seeds are sown and covered, the surface should again be firmed by means of a smooth board.

No definite rule can be given for the depth to which seeds should be planted, for the depth should vary

with the kind of seed and with the character and condition of the soil. In heavy clay and moist soils the covering should be lighter than in sandy or dry soils. In all cases the depth should be uniform, and when planting seeds in boxes or a bed the grooves in which the seeds are planted should be made with the edge of a thin lath.

Care of the Seed Bed

The seed bed should never be allowed to become dry, but great care should be taken that too much water is not applied. Plants require the action of air upon their roots, and an excess of water in the soil will exclude the air. Too frequent and heavy waterings will cause the damping-off of the seedlings.

The Handling of Plants

Successful transplanting of indoor-grown plants to the garden or field depends largely upon their proper treatment during the two weeks preceding the time of their removal. Spindling and tender plants will not withstand the exposure of the open ground so well as sturdy, well-grown plants, such as may be secured by proper handling.

Hardening Off

Plants grown in a house, hotbed, or cold frame will require to be hardened off before planting in the garden. By the process of hardening off, the plants are gradually acclimated to the effects of the sun and wind so that they will stand transplanting to the open ground. Hardening off is usually accomplished by ventilating freely and by reducing the amount of water

applied to the plant bed. The plant bed should not become so dry that the plants will wilt or be seriously checked in their growth. After a few days it will be possible to leave the plants uncovered during the entire day and on mild nights. By the time the plants are required for setting in the garden they should be thoroughly acclimated to outdoor conditions and can be transplanted with but few losses.

Special Methods of Transplanting

A large number of garden crops, including melons, cucumbers, and beans, do not transplant readily from the seed bed to the open ground, and some special means for handling the plants must be employed where extra early planting is desired. A common practice among gardeners is to fill pint or quart berry boxes with good soil and plant a single hill in each box.

Another method is to cut sods into pieces about 2 inches thick and 6 inches square and place them, root side upward, on the greenhouse bench or in the hotbed, the hills being planted in the loamy soil held in place by the roots of the grass. When the weather becomes sufficiently warm, and it is desired to set the plants in the garden, the berry boxes or pieces of sod are placed on a flat tray and carried to the place where the planting is to be done. Holes of sufficient size and depth are dug and the boxes or sods are simply buried at the points where it is desired to have the hills of plants. The boxes should be placed a little below the surface, and fine earth worked in around the plants. If it is thought desirable, the bottoms of the boxes may be cut away when set in the garden.

Setting in the Open Ground

A few hours before removing plants from the seed bed or plant bed they should be well watered and the water allowed to soak into the soil. This will insure a portion of the soil adhering to the roots and prevent the plants from wilting. If the plants have been properly thinned or transplanted it is often possible to run a knife or trowel between them, thus cutting the soil into cubes that are transferred with them to the garden.

Where the soil does not adhere to the roots of the plants it is well to puddle them. In the process of puddling, a hole is dug in the earth near the plant bed, or a large pail may be used for the purpose; and a thin slime, consisting of clay, cow manure, and water, is prepared. The plants are taken in small bunches and their roots thoroughly coated with this mixture by dipping them up and down in the puddle a few times. Puddling insures a coating of moist earth over the entire root system of the plant, prevents the air from reaching the rootlets while on the way to the garden, and aids in securing direct contact between the roots and the soil.

Previous to setting out plants, the land should be worked over and put in good condition, and everything should be ready for quick operations when a suitable time arrives. The rows should be measured off, but it is well to defer making the furrows or digging the holes until ready to plant, in order to have the soil fresh. The time best suited for transferring plants from the plant bed to the open ground is when there is considerable moisture in the air and clouds obscure the sun, and if the plants can be set before a shower

there will be no difficulty in getting them to grow. During seasons when there is very little rain at planting time, or in irrigated regions, evening is the best time to set the plants.

It is possible to set plants in quite dry soil, provided the roots are puddled and the earth well packed about them. When water is used in setting plants it should be applied after the hole has been partially filled, and the moist earth should then be covered with dry soil to prevent baking. Where water is available for irrigation it will be sufficient to puddle the roots and then irrigate after the plants are all in place.

Plants should be set a trifle deeper in the garden than they were in the plant bed. The majority of plants require to be set upright, and where the dibble is used for planting, care should be taken that the soil is well pressed around the roots and no air spaces left

Time of Planting

No definite rule can be given regarding the time for planting seeds and plants in the garden, for the date varies with the locality and the time that it is desired to have the crop mature. A little practice will soon determine when and how often sowings should be made in order to escape frost and mature the crop at a time when it will be most useful. Certain crops will not thrive during the heated part of the summer, and their time of planting must be planned accordingly.

Protection of Plants

Some plants require protection from the direct rays of the sun in summer or from cold in winter, and there are many that need special protection while they are

quite small. Seedlings of many of the garden crops are unable to force their way through the crust formed on the soil after heavy rains, and it is necessary either to break the crust with a steel rake or soften it by watering.

Protection from Heat

In parts of the country where the sunshine is extremely hot during a part of the summer, some plants, especially those that are grown for salad purposes, are benefited by shading. Shading is often used in the care of small plants when they are first transplanted.

Where boards are available they can be used for protecting plants that have been set in rows in the garden, by placing them on the south side of the row at an angle that will cast a shadow over the plants, and holding them in place by short stakes driven in the ground. Laths, wooden slats, cotton cloth, or shaded sash are frequently used to protect plant beds from the heat of summer.

Protection from Cold

For protecting plants from cold in winter several kinds of materials are used, such as boards, cloth, pine boughs, straw, manure, or leaves. There are a number of crops of a tropical nature that may be grown far north, provided they are properly protected during the winter.

Several of the annual crops can be matured much earlier in the spring if they are planted in the autumn and protected during the winter. Plants of this kind can often be protected by means of boards set at an angle on the north side of the row instead of on the south. A mulch of manure, straw, or leaves forms a good protection, but care should be taken that the

mulch does not contain seeds of any kind, or serious trouble will attend the further cultivation of the crop. Plants are like animals in that they require air, and care should be exercised in putting on the winter covering not to smother them. Coarse, loose materials are better for a winter covering then fine, easily-compacted substances.

Cultivation of Garden Crops

Frequent shallow cultivation should be employed for most garden crops, and during dry weather the depth should not exceed 2 inches. By keeping the surface soil well stirred what is termed a " dust mulch " is formed, and while this layer of finely divided soil will become quite dry it prevents the escape of moisture through the pores of the soil. A mulch consisting of fine manure, clippings from the lawn, or any similar material, spread to a distance of 10 or 12 inches around the plants will preserve the moisture; but the mulch should not be so heavy as to exclude the air.

A crust forming over the soil after a rain or watering is detrimental to plant growth, and should be broken up as soon as the land can be worked. To determine when the soil is sufficiently dry for cultivation, apply the usual test of squeezing in the hand. Sandy soils can be worked much sooner than clay soils after a rain. Too much importance can not be placed upon the matter of thorough cultivation of the garden, and if the work is promptly and properly done there will be little difficulty in controlling weeds.

Tools for Use in the Garden

There are a number of one-horse cultivators that are especially adapted for work in the garden. These

may be provided with several sizes of teeth and shovels, and are easily transformed for various kinds of work. In working the crops while they are small, the harrow or smaller teeth may be used, and later when the plants become larger, the size of the shovels may be increased. Many gardeners, however, prefer to use the harrow teeth at all times.

When it is desirable to ridge up the soil around a crop, the wings, or hillers, may be put on either side of the cultivator. A one-horse turning plow is useful for running off rows or throwing up ridges. Aside from the horse tools in general use on the farm, there are only one or two cultivators that will be required for the garden, and these are not expensive.

The outfit of hand tools for the garden should include a spade, a spading fork, a cut-steel rake, a 10-foot measuring pole, a line for laying off rows, a standard hoe, a narrow hoe, dibbles, a trowel, an assortment of hand weeders, a watering can, a wheelbarrow, and if the work is to be done largely by hand the outfit should also include some form of wheel hoe, of which there are a number on the market.

Irrigation of Garden Crops

Throughout the portions of the country where rains occur during the growing season, it should not be necessary to irrigate in order to produce the ordinary garden crops. In arid regions, where irrigation must be depended upon for the production of crops, the system best adapted for use in that particular locality should be employed in the garden. Wherever irrigation is practiced the water should not be applied until needed, and then the soil should be thoroughly soaked. After irrigation, the land should be cultivated as soon

as the surface becomes sufficiently dry, and no more water should be applied until the plants begin to show the need of additional moisture. Constant or excessive watering is very detrimental in every case. Apply the water at any time of the day that is most convenient and when the plants require it.

By the subirrigation method of watering, lines of farm drain tiles or perforated pipes are laid on a level a few inches below the surface of the soil. This system is especially adapted for use in back-yard gardens where city water is available and where the area under cultivation is small. Subirrigation is expensive to install, as the lines of tiles should be about 3 feet apart, or one line for each standard row. By connecting the tiles at one end by means of a tile across the rows, the water may be discharged into the tiles at one point from a hose, and will find its way to all parts of the system, entering the soil through the openings.

For further information on irrigation see Farmers' Bulletin No. 138, entitled "Irrigation in Field and Garden."

Precautions to Avoid Attacks of Insects and Diseases

In the control of insects and diseases that infest garden crops it is often possible to accomplish a great amount of good by careful sanitary management. In the autumn, after the crops have been harvested, or as fast as any crop is disposed of, any refuse that remains should be gathered and placed in the compost heap, or burned if diseased or infested with insects. Several of the garden insects find protection during the winter under boards and any loose material that may remain in the garden. Dead vines or leaves of plants are frequently covered with spores of diseases that

affect those crops during the growing season, and these should be burned, as they possess very little fertilizing value.

For information on garden insects and their control, address the Bureau of Entomology of this Department.

The diseases of garden crops are too numerous for attention in a publication of this nature. Specific information can be secured by addressing the Chief of the Bureau of Plant Industry of this Department.

Cultural Hints for Garden Crops

Artichoke, Globe

Deep, rich sandy loam, with a liberal supply of well-rotted manure, is best suited for growing artichokes. Plant the seeds as soon as the soil is warm in the spring, and when the plants have formed three or four leaves they may be transplanted to rows 3 feet apart and 2 feet apart in the row. The plants do not produce until the second season, and in cold localities some form of covering will be necessary during the winter. This crop is not suited for cultivation north of the line of zero temperature.

After the bed is once established, the plants may be reset each year by using the side shoots from the base of the old plants. If not reset, the bed will continue to produce for several years, but the burs will not be so large as from new plants. The bur, or flower bud is the part used, and the burs should be gathered before the blossom part appears. If they are removed and no seed is allowed to form, the plants will continue to produce until the end of the season.

The heads, or burs, of the French artichoke are prepared for the table by boiling, and served with melted butter or with cream dressing.

Artichoke, Jerusalem

The Jerusalem artichoke will grow in any good garden soil, and should be planted 3 to 4 feet apart each way, with three or four small tubers in a hill. If large tubers are used for planting they should be cut the same as Irish potatoes. Plant as soon as the ground becomes warm in the spring and cultivate as for corn. A pint of tubers cut to eyes will plant about thirty hills. The tubers will be ready for use in October, but may remain in the ground and be dug at any time during the winter.

The tubers are prepared by boiling until soft, and are served with butter, or creamed. They are also used for salads and pickles.

The Jerusalem artichoke is not of great importance as a garden vegetable, and the plant has a tendency to become a weed.

Asparagus

Asparagus should have a place in every home vegetable garden where it will thrive. This crop can be grown on almost any well-drained soil, but will do best on a deep mellow, sandy loam. There is little possibility of having the land too rich, and liberal applications of partly rotted barnyard manure should be made before the plants are set. The seeds of asparagus may be sown during the early spring in the rows where the plants are to remain, and the seedlings thinned to stand 14 inches apart in the row at the end of the first season. It is usually more satisfactory to purchase two-year-old roots from some seedsman or dealer. The price of good roots is generally about $1.25 per hundred, and one to two hundred plants will be found sufficient to supply the ordinary family.

The roots should be transplanted during the late autumn or early spring.

Before setting out the plants the land should be loosened very deeply, either by subsoil plowing or deep spading. It is a good plan to remove the topsoil, and spade manure into the subsoil to a depth of 14 or 16 inches; then replace the topsoil and add more manure. There are two methods of setting an asparagus bed, depending entirely upon the kind of cultivation to be employed in the garden. If horse tools are to be used, the plants should be set in rows 3½ feet apart and 14 inches apart in the row. On the other hand, if the garden space is limited, the plants should be set in a solid bed, 1 foot apart each way, and cultivated by hand. In setting asparagus the crowns should be covered to a depth of 4 or 5 inches. At the North it will be desirable to mulch the asparagus bed during the winter with 3 or 4 inches of loose manure or straw. In the South the covering during the winter will not be necessary, but the bed should receive a dressing of manure or fertilizer at some time each year, preferably in the autumn.

The part of the asparagus used as a vegetable is the young shoots that are thrown up during the early spring. The shoots are removed when about 4 or 5 inches in length by cutting slightly below the surface of the ground, but care should be taken that the knife is not thrust at an angle or the crowns will be injured. If so desired, the shoots may be blanched by ridging up over the rows with loose, sandy soil or by allowing the mulch to remain and the shoots to make their way through it, but unblanched asparagus always has a better flavor than blanched, is more easily produced, and is most satisfactory for home use. Too

heavy mulching has a tendency to retard the growth of the shoots by keeping the ground cold until late in the spring.

No shoots should be removed the first year the plants are set in the permanent bed, and the period of cutting should be short the second year. After the second year the plants become well established, and with proper fertilizing and care the bed will last indefinitely. During the cutting season all of the shoots should be removed, as the roots will cease to throw up shoots as soon as one is allowed to mature. When the shoots become tough and stringy, or are no longer desired for use, the cutting should cease and the tops should be allowed to grow during the summer. Late in the autumn, when the tops become dead, they can be removed and burned, the soil between the rows cultivated, and a fertilizer or mulch applied. For full information, see Farmers' Bulletin No. 61, entitled "Asparagus Culture."

There are several methods of preparing asparagus shoots for the table, the more common of which are as follows:

(1) Boil the shoots until tender in water to which a small quantity of salt has been added; serve while hot, as greens, with a little butter, vinegar, salt, and pepper.

(2) Boil as above and serve either with plain butter, or creamed. The shoots can be cooked entire or cut into short pieces, and when creamed they are frequently served on toast.

Beans

Beans thrive best in a rather warm, sandy loam, but may be grown on almost any kind of soil. For the best results the soil should not be too rich in nitrogenous

matter, or the plants will run to foliage and stems at the expense of the crop of pods. Heavy clay soils are not well adapted to bean culture, owing to the tendency of the soil to bake and prevent the seedlings from coming up evenly. The bean does not draw heavily upon the soil and is suitable for rotation with other garden crops.

Beans will not withstand frost, and the first plantings in the spring are frequently lost in this manner. It is very little trouble, however, to make a planting of beans, and the first planting should be made as soon as the ground is reasonably warm; this to be followed by a second and a third planting at intervals of about a week or ten days. It sometimes happens that the first planting will be killed by frost, and that the second will come through the ground immediately after the frost and mature several days ahead of those planted to replace the ones that were killed.

There are several classes of edible beans, including both climbing and bush sorts, all of which are valuable as foods and of great commercial importance. The various types and varieties of beans are too numerous for discussion here, and a few cultural hints only will be given.

In the cultivation of beans, the general rules for the care of garden crops should be adhered to, and frequent shallow stirring of the soil practiced. For a constant supply of bunch or snap beans, successive plantings should be made, the final planting being made about 8 weeks before time for frost in the autumn. In the South, plantings should be made as soon as the ground begins to warm, and continue until hot weather sets in. Toward the end of summer one or two plantings should be made for a fall crop.

For the production of bunch dry beans, such as Red Kidney, White Kidney, or White Marrow, plantings may be made almost any time during the first half of the summer. This class of bean is generally planted as late as possible to have the crop ripen just before early frost in the autumn. Bunch beans are generally planted in rows 30 inches apart, and the plants allowed to stand singly 3 or 4 inches apart, or they are planted in hills of 3 to 5 plants each, 12 to 15 inches apart. Good results may be obtained from planting Kidney or Marrow beans in the cornfield alongside the hills after the corn has been cultivated once or twice.

Pole beans require a somewhat richer soil than the bunch type, and should be planted in hills 3 by 4 or 4 by 4 feet, and, as the name implies, they require a pole or some similar support. Plant the seed during the early summer. Several varieties of climbing bean may be planted in the cornfield and allowed to climb upon the hills of corn. The old-fashioned corn bean belongs to this type.

The Lima bean, both pole and bush, forms one of the most desirable products of the garden. This crop thrives best when the soil is quite rich; in fact, good Lima beans can not be grown in poor soil. They should not be planted until the soil becomes thoroughly warm. Place the seed in hills, 8 or 10 to the hill, and after the plants become established thin to 4 or 5. The hills should be 4 or 5 feet apart for the pole varieties and 2 or 3 feet apart for the dwarf or bunch varieties. It is a good plan to make up the hill with a little additional manure well mixed with the soil. Cover the beans about 1½ inches, placing them with the eye downward.

When planting beans of any kind, the seed should not

be covered to a greater depth than 2 inches when the soil is moderately dry, and if the soil is wet, the covering should be very slight.

For additional information the reader is referred to Farmers' Bulletin No. 121, entitled "Beans, Peas, and Other Legumes as Food."

Beets

The red garden beet may be grown in any good soil, but rich sandy loam will give the best results. Sow the seeds in the spring as soon as danger of frost has passed. Beets should be planted in drills 12 to 18 inches apart, and when the plants are well up they should be thinned to 4 or 5 inches in the row. If desirable to plant in rows 3 feet apart for horse cultivation, the seeds may be sown in a double drill with 6 inches between, leaving 30 inches for cultivation. Two ounces of beet seed are required to plant 100 feet of row, or 5 pounds to the acre. As a rule each seed ball contains more than one seed, and this accounts for beets coming up very thickly. The seed should be covered to a depth of about 1 inch. For a succession of young beets during the summer, plantings should be made every 4 or 5 weeks during the spring months. Beets intended for winter storage should not be sown until late in the summer, the crop being harvested and stored in the same manner as turnips. Sugar beets are often substituted for the ordinary garden beet, especially for winter use.

Beets are used for pickles, or are boiled, sliced, and fried in butter, adding a little vinegar just before removing from the fire. The young plants are used for greens.

Borecole (See Kale)

Brussels Sprouts

This crop is closely related to cabbage and cauliflower, and may be grown in the same manner. Instead of a single head, Brussels sprouts form a large number of small heads in the axils of the leaves. As the heads begin to crowd, the leaves should be broken from the stem of the plant to give them more room. A few leaves should be left at the top of the stem where the new heads are being formed. Brussels sprouts are more hardy than cabbage, and in mild climates may remain in the open ground all winter, the heads being removed as desired. For winter use in cold localities, take up plants that are well laden with heads and set them close together in a pit, cold frame, or cellar, with a little soil around the roots. The uses of Brussels sprouts are similar to those of cabbage, but they are considered to be of a superior flavor.

Bur Artichoke (See Artichoke, Globe)

Cabbage

For early spring cabbage in the South, sow the seeds in an outdoor bed and transplant to the garden before January 1. In the North, plant the seeds in a hotbed during February and set the plants in the open ground as early as the soil can be worked. For a late crop in the North, plant the seeds in a bed in the open ground in May or June and transplant to the garden in July. Early cabbages require a rich, warm soil in order that they may mature early. For late cabbages the soil should be heavier and more retentive of moisture and not so rich as for the early crop, as the heads are liable

to burst. Cabbages should be set in rows 30 to 36 inches apart and 14 to 18 inches apart in the row. Where the plants are set out in the autumn and allowed to remain in the ground over winter, they are usually placed on top of ridges. Early cabbage must be used soon after it has formed solid heads, as it will not keep during hot weather.

Late cabbage may be buried in pits or stored in cellars or specially constructed houses. The usual method of storing cabbage is to dig a trench about 18 inches deep and 3 feet wide and set the cabbage upright, with the heads close together and the roots bedded in soil. As cold weather comes on, the heads are covered slightly with straw and then 3 or 4 inches of earth put on. Slight freezing does not injure cabbage, but it should not be subjected to repeated freezing and thawing. If stored in a cellar or building, the heads are generally cut from the stems and stored on slatted shelves or in shallow bins. While in storage, cabbage should be well ventilated and kept as cool as possible without freezing.

Cantaloupe (See Melon—Muskmelon)

Cardoon

The cardoon is a thistle-like plant, very similar in appearance to the Globe artichoke, but is grown as an annual. The seeds are sown in early spring in a hotbed or cold frame, and the plants transplanted later to the open ground. The cardoon should be planted in rows 3 feet apart and 18 inches apart in the row on rich soil, where it can secure plenty of moisture and make rapid growth. Toward autumn the leaves are drawn together, and the center blanched in the same

manner as endive. If intended for winter use, the leaves are not blanched in the garden, but the plants are lifted with considerable earth adhering to the roots and stored closely in a dark pit or cellar to blanch.

The blanched leaf stems are used for making salads, soups, and stews.

Carrot

The culture of the carrot is practically the same as the parsnip, except that carrots are not thinned so much and are allowed to grow almost as thickly as planted. Carrots should be dug in the autumn and stored the same as parsnips or turnips. Any surplus can be fed sparingly to horses, mules, or cattle.

The roots of the carrot are used at all times of the year, mostly in soups, but they may be boiled and served with butter, or creamed.

Cauliflower

Cauliflower requires a rich, moist soil, and thrives best under irrigation. Cauliflower will not withstand as much frost as cabbage. The culture is the same as for cabbage until the heads begin to develop, after which the leaves may be tied together over the heads in order to exclude the light and keep the heads white.

The tender heads of cauliflower are boiled and served with butter, or creamed, and are also used for pickling.

Celeriac

A large-rooted form of celery used for cooking only. Cultivate the same as celery, but banking or blanching is not required. The roots may remain in the ground until wanted for use, provided a light covering be applied to prevent freezing.

Celery

For the North, sow the seed in a hotbed or cold frame and transplant to the open ground. Celery plants are generally improved by transplanting twice. In the South the plants are not started until late in the summer and the crop is matured during the early winter. Celery seeds are very small and are slow in germinating, and the temperature of the seed bed should be kept low. The seed bed should be especially well prepared and the seeds should not be covered to a greater depth then $\frac{1}{8}$ inch. Watering should be attended to very carefully and the bed should not dry out. After the plants are up, care should be taken that the bed does not become too wet and the plants damp off. Five hundred plants will be sufficient for the ordinary family, and they should be set 6 inches apart in rows 3 to 5 feet apart.

Celery requires a deep, rich, moist soil, with plenty of well-rotted barnyard manure or fertilizer and frequent shallow cultivation. In the garden, celery may be planted after some early crop, such as lettuce, radishes, peas, or beans. As soon as the plants attain considerable size the leaves should be drawn up and a little soil compacted about the base of the plant to hold it upright. If the blanching is done with earth, care should be taken that the hearts of the plants do not become filled. Boards, paper, drain tiles, or anything that will exclude the light may be used for blanching, but earthing up will produce the finest flavor.

Celery may be kept for winter use by banking with earth and covering the tops by means of leaves or straw to keep it from freezing, or it may be dug and re-

moved to a cellar, cold frame, vacant hotbed, or pit, and reset close together, with the roots bedded in earth. While in storage, celery should be kept as cool as possible without freezing.

The blanched stems of celery are eaten in the raw state, and both the stems and enlarged roots are stewed and creamed. Celery seed is used for flavoring soups and pickles.

For further information on celery read Farmers' Bulletin No. 148, entitled " Celery Culture."

Chervil

Under the name of chervil two distinct plants, known as salad chervil and the turnip-rooted chervil, are cultivated. The seeds of the salad chervil are sown in spring and the crop will thrive on any good garden soil. The seeds of the turnip-rooted chervil should be sown in the early autumn, but they will not germinate until the following spring.

The edible part of this plant is the root, which somewhat resembles the carrot and is used in the same manner. The leaves are used the same as parsley for garnishing and in flavoring soups.

Chicory

Chicory is grown for two or three purposes. The root of this plant is the common adulterant of coffee, and large quantities are used for this purpose. The commercial growing of chicory is confined to a few sections, as the crop will not thrive on every kind of soil.

A deep, rich loam, without excessive amounts of clay or sand, is desirable, and soil that is not too rich in

nitrogenous matter is best suited to the production of roots.

The roots of chicory are frequently placed in soil under a greenhouse bench or in a warm cellar and covered with a foot or more of straw, or with a light covering of straw and then several inches of warm manure. Under this covering the leaves will be formed in a solid head, which is known on the market as witloof.

Chicory has run wild in some parts of the country and is considered a bad weed. The handsome blue flowers of the chicory, which are borne the second season, are very attractive.

As a pot herb, chicory is used like spinach, but the leaves should be boiled in two waters to remove the bitter taste. As a salad the roots are dug in the autumn and planted in cellars or under a greenhouse bench, where they produce an abundance of blanched leaves, which are eaten raw. The blanched leaves are also boiled and used as greens.

Chive

This is a small onion-like plant having flat, hollow leaves which are used for flavoring soups. The chive rarely forms seeds, and it is propagated by the bulbs, which grow in clusters. The leaves may be cut freely and are soon replaced by others.

Cibol (See Onion)

Citron

The citron is a type of watermelon with solid flesh which is used for preserves and sweet pickles. The rind of the watermelon is frequently substituted for

citron. The cultivation of the citron is the same as for the watermelon.

Cive (See Chive)

Collards

The culture and uses of collards are the same as for cabbage and kale. Collards withstand the heat better than either cabbage or kale, and a type known as Georgia collards is highly esteemed in the Southern States. Collards do not form a true head, but instead a loose rosette of leaves, which, when blanched, are very tender and of delicate flavor.

Corn Salad

Corn salad is also known as lamb's-lettuce and fetticus. Sow the seed during the early spring in drills 14 to 18 inches apart and cultivate the same as for lettuce or mustard. For an extra early crop the seed may be planted during the autumn and the plants covered lightly during the winter. In the Southern States the covering will not be necessary and the plants will be ready for use during February and March. The leaves are frequently used in their natural green state, but they may be blanched by covering the rows with anything that will exclude the light. Corn salad is used as a salad in place of lettuce, or mixed with lettuce or water cress. The flavor of corn salad is very mild, and it is improved by mixing with some other salad plant for use. It is also boiled with mustard for greens.

Corn, Sweet

Plant sweet corn as soon as the soil is warm in the spring, and make successive plantings every two weeks

until July, or the same result can be attained to some extent by a careful selection of early, medium, and late varieties. Plant the seeds in drills 3 feet apart and thin to a single stalk every 10 to 14 inches, or plant 5 to 6 seeds in hills 3 feet apart each way, and thin out to 3 to 5 stalks in a hill. Cover the seeds about 2 inches deep. Cultivate frequently and keep down all weeds, removing suckers from around the base of the stalk.

Sweet corn should be planted on rich land, and the method of cultivation is practically the same as for field corn, but should be more thorough. There are a number of good early varieties, and for a midsummer and late sort there is none better then Stowell's Evergreen.

Cress

Under the name of cress there are two forms, the water cress and the upland cress. The upland cress, sometimes called peppergrass, is easily grown from seed sown in drills a foot apart. As the plants last but a short time, it will be necessary to make a sowing every few days if a continuous supply is desired.

Water cress can be grown all the year in small open ditches containing running spring water. It is best and most easily produced in water from rather warm springs in limestone regions. A sufficient supply for family use can be grown in a small spring-fed brook, and the plants may be started either from small pieces of plants or from seed. Cress is used in salads, to which it imparts a pleasant pungency.

Cucumber

The soil for cucumbers should be a rich sandy loam, rather moist, but not wet. Plant in hills 4 feet apart

each way as soon as all danger of frost is past. It is a good plan to work thoroughly a shovelful of well-rotted manure or a small handful of fertilizer into each hill in addition to the regular manuring of the land. The manure in the hill will give the plants a good start. Cucumbers are frequently planted in drills about 7 feet apart and thinned to 12 or 18 inches apart in the row. If it is desirable to secure extra early cucumbers, the plants may be started in a hot-bed and transplanted to the garden by means of berry boxes. In the South, cucumbers are planted in the open ground as early as February or March. Cucumber seedlings are easily injured by cold, even where no frost occurs, and throughout the northern part of the country the planting should be deferred until the soil is warm.

While young, the cucumber plants are frequently destroyed by a small beetle that attacks the lower part of the stem and the under side of the leaves. To preserve the plants some remedy will be necessary, and where only a few hills are grown for family use the beetles may be kept off by covering the plants with frames over which fly screen or mosquito netting has been stretched. Another method of protecting the plants is to set an arch of wire or one-half of a barrel hoop over the hill, and spread a piece of mosquito netting over this support. The edges of the netting may be laid down by covering with earth, and as soon as the plants are beyond danger of attack, the netting may be stored for future use.

For further information on the protection of cucumber plants from the striped beetle see Circulars 31 and 59 of the Bureau of Entomology.

Cucumbers should receive frequent shallow cultiva-

tion until the vines begin to run freely; after this very little attention is required except to pull out stray weeds as they may appear. In order to keep the vines in good bearing condition, no fruit should be allowed to ripen, and when grown for pickles the fruits should all be removed while quite small.

As cucumbers are subject to several diseases, the old vines and fruits should all be destroyed and the crop should not be planted two years in succession on the same land. As a rule garden cucumbers and melons will not be greatly injured by diseases. Full information on this subject can be secured by consulting Farmers' Bulletin No. 231, entitled "Spraying for Cucumber and Melon Diseases."

Dandelion

Sow the seed of dandelion in spring in drills 18 inches apart, covering it ½ inch deep. Thin the plants to about 12 inches apart and give good clean cultivation throughout the summer. In the colder parts of the country it may be desirable to mulch slightly during the winter to prevent the plants heaving out of the soil. Early the following spring the plants will be ready for use as greens, but they are greatly improved if blanched by setting two boards in the form of an inverted letter V over the row. The blanching not only makes the leaves more tender but destroys a part of the bitter taste. Dandelion greens should be boiled in two waters to remove the bitterness.

Eggplant

The plants for this crop should be started and handled in the same manner as described for the tomato.

After the weather has become settled and the ground quite warm, set the plants in the garden in rows 3 feet apart and 2 feet apart in the row. The soil best adapted to the production of eggplant is a fine, rich sandy loam; and it should be well drained. Cultivate freely and keep the plants growing rapidly. Many growers believe that fresh stable manure should not be used in connection with the growing of eggplant and that the land should not contain unfermented vegetable matter to any extent.

Eggplant is used in several ways, among which are the following: Peel and cut into slices $\frac{1}{2}$ inch thick, soak in salt water 1 hour; boil until tender; then coat with rolled crackers or flour and fry in butter or fat. Another method is to steam or bake the eggplant whole and serve in the shell, the pulp being eaten with salt, pepper, and butter.

Endive

The endive is a form of chicory. Sow the seeds thinly in drills, and when the plants are well established thin to 8 inches. Water and cultivate thoroughly in order that a good growth of leaves may be made. When the leaves are 6 to 8 inches in length, draw them together and tie them so the heart will blanch. The leaves should not be tied up while wet, or decay will follow. The heads should be used as soon as blanched. For winter use, sow the seeds rather late and remove the plants, with a ball of earth adhering to the roots, to a cellar or cold frame, and blanch during the winter as required for use.

Endive is used as a salad at times of the year when lettuce and similar crops are out of season.

Fetticus (See Corn Salad)

Flag (See Leek)

French Artichoke (See Artichoke, Globe)

Garlic

Garlic is closely allied to the onion, but will remain in the ground from 1 year to another if undisturbed. Garlic is planted by setting the small bulbs, or cloves, either in the autumn or early spring. The culture is practically the same as for the onion. The bulbs are used for flavoring purposes.

Georgia Collards (See Collards)

German Celery (See Celeriac)

Ground Cherry (See Physalis)

Gumbo (See Okra)

Horse-radish

Horse-radish will thrive best in a deep, rich soil, where there is plenty of moisture. The rows should be 3 feet apart and the plants 12 to 18 inches apart in the row. Tops cut from large roots or pieces of small roots are used for planting. A comparatively few hills of horse-radish will be sufficient for family use, and the roots required for starting can be secured of seedsmen for 25 or 30 cents a dozen. This crop will require no particular cultivation except to keep down the weeds, and is inclined to become a weed itself if not controlled.

The large fleshy roots are prepared for use by peeling and grating. The grated root is treated with a little salt and vinegar and served as a relish with meats, oysters, etc. The roots should be dug during

the winter or early spring before the leaves start. After being treated with salt and vinegar, the grated root may be bottled for summer use.

Husk Tomato (See Physalis)

Irish Potato (See Potato, Irish)

Jerusalem Artichoke (See Artichoke, Jerusalem)

Kale, or Borecole

There are a large number of forms of kale, and these are thought by some to be the original type of the cabbage. Kale does not form a head and has convoluted leaves and thick leaf stems. It is cultivated the same as cabbage, but may be set somewhat closer. This crop is very hardy and will live through the winter in the open ground in localities where freezing is not too severe. The flavor of kale is improved by frost.

Kale is used for greens during the winter, and as a substitute for cabbage.

Kohl-rabi

Kohl-rabi belongs to the same class as cabbage and cauliflower, but presents a marked variation from either. It is, perhaps, half-way between the cabbage and turnip, in that its edible part consists of the swollen stem of the plant. For an early crop, plant and cultivate the same as for early cabbage. For a late crop or for all seasons in the South, the seed may be sown in drills where the crop is to be grown, and thinned to about 8 inches apart in the row. The rows should be from 18 to 36 inches apart, according to the kind of cultivation employed. The fleshy stems should be used while they are young and quite tender.

Prepare kohl-rabi for the table in the same manner as turnips, which it very much resembles when cooked.

Lamb's-Lettuce (See Corn Salad)

Leek

This plant belongs to the same class as does the onion, but requires somewhat different treatment. Leeks can be grown on any good garden soil and are usually sown in a shallow trench. The plants should be thinned to stand about 4 inches apart in the row, and the cultivation should be similar to that for onions. After the plants have attained almost full size, the earth is drawn around them to the height of 6 or 8 inches to blanch the fleshy stem. The leek does not form a true bulb like the onion, but the stem is uniformly thick throughout. Leeks are marketed in bunches like young onions, and they may be stored the same as celery for winter.

Leeks are used for flavoring purposes and are boiled and served with a cream dressing the same as young onions.

Lettuce

This crop attains its best development in a rich sandy loam in which there is plenty of organic matter. Lettuce thrives best during the early spring or late autumn and will not withstand the heat of summer. In order that the leaves may be crisp and tender, it is necessary to force the growth. The usual method of growing lettuce for home use is to sow the seeds broadcast in a bed and remove the leaves from the plants as rapidly as they become large enough for use. A much better method is either to thin or transplant the seedlings and allow the plants to form

rather compact heads and then cut the entire plant for use.

In the Southern States, the seeds may be sown during the autumn and the plants allowed to remain in the ground over winter. At the North, the seeds may be sown in a hotbed or cold frame and the seedlings transplanted to the open ground, or the seeding may be in rows in the garden and the plants thinned to 5 or 6 inches in the row. Lettuce may be grown in rows about 12 inches apart. In order to produce crisp and tender lettuce during the summer months, it may be necessary to provide some form of partial shading.

Melon—Muskmelon.

A sandy loam with plenty of well-rotted barnyard manure will be found to be adapted to the cultivation of the muskmelon. When commercial fertilizer is used instead of manure, it should be applied at the rate of from 500 to 1,000 pounds of high-grade material to the acre. The muskmelon requires a long season to develop and is easily injured by frost or even by cool weather.

For an early crop in the North, start the hills in a hotbed in berry boxes and plant out after the soil becomes warm. For the main crop throughout the country the seeds are planted in the open ground as soon as the soil is reasonably warm. Place the hills about 6 feet apart each way, with 8 or 10 seeds in a hill. After the plants become established, thin out all but the four best ones. Another method is to sow in drills and thin to single plants 18 inches to 2 feet apart. Good cultivation should be maintained until the vines interfere.

Muskmelons are subject to a number of diseases,

and while the plants are quite young they are attacked by the cucumber beetle. The same precautionary measures as are recommended in the case of cucumbers should be observed for both troubles.

There are a number of good varieties of muskmelons, and the Rocky Ford, or Netted Gem, is one of the best.

Melon—Watermelon

The cultivation of the watermelon is practically the same as for the muskmelon, except that the plants grow larger and require more room for development than those of the muskmelon. Watermelons require that the soil should contain a larger percentage of sand than muskmelons, and that the land should be quite rich. Watermelons should be planted 10 feet each way between the hills, or in drills 10 feet apart and thinned to 3 feet apart in the drills. The watermelon seedlings must be protected from the cucumber beetle until the foliage becomes toughened.

Multiplier Onion (See Onion)

Muskmelon (See Melon—Muskmelon)

Mustard

Almost any good soil will produce a crop of mustard. The basal leaves of mustard are used for greens, and as the plants require but a short time to reach the proper stage for use, frequent sowings should be made. Sow the seeds thickly in drills as early as possible in the spring, or for late use sow the seeds in September or October. The forms of white mustard, of which the leaves are often curled and frilled, are generally used. Mustard greens are cooked like spinach.

New Zealand Spinach

The plant known as New Zealand spinach is not a true spinach, but grows much larger and should be planted in rows 3 feet apart, with the plants 12 to 18 inches apart in the row. Some difficulty may be experienced in getting the seeds to germinate, and they should be soaked 1 or 2 hours in hot water before planting. New Zealand spinach is satisfactory for growing in warm climates, as it withstands heat better than the ordinary spinach. The fleshy leaves and tender stems are cooked the same as spinach.

Okra, or Gumbo

Sow the seeds of okra in the open after the ground has become quite warm, or start the plants in berry boxes in a hotbed and transplant them to the garden after all danger of frost is past. The rows should be 4 feet apart for the dwarf sorts and 5 feet apart for the tall kinds, with the plants 2 feet apart in the row. Okra does best in rather rich land and requires frequent shallow cultivation until the plants cover the ground. The young pods are the part used, and these are employed principally in soups, to which they impart a pleasant flavor and mucilaginous consistency. If the pods are removed from the plants and none allowed to ripen, the plants will continue to produce pods until killed by frost, but the best pods are grown on young plants. Okra pods can be dried or canned for winter use.

For further information on okra, see Farmers' Bulletin No. 232, entitled "Okra: Its Culture and Uses."

Onions

A rich sandy loam containing plenty of humus is best suited to the production of onions. This crop has been grown very successfully on the muck beds of the States bordering on the Great Lakes. The usual plan on a small scale is to plant 1 or 2 quarts of "sets" in drills 12 to 18 inches apart and 2 to 3 inches apart in the row, covering about an inch deep. When a large acreage is to be grown the soil is made very fine and smooth and the onion seed is sown in drills and then thinned to 2 or 3 inches apart after the plants become established. For the best results from seed, sow in cold frames during the fall or in a hotbed in the early spring and transplant to the open ground as soon as the soil is in good condition to work.

Onions require frequent shallow cultivation and it may be necessary to resort to hand work in order to keep the crop free from weeds. If it is desired to hasten the maturity of the bulbs by preventing continued growth of the tops, this may be accomplished by rolling an empty barrel over the rows and breaking down the tops. After the tops are practically dead the onion bulbs should be removed from the soil and spread in a dry, well ventilated place to cure, after which they may be stored in crates or bags for winter use.

There are several kinds of onions that may remain in the soil over winter. The Multiplier or Potato onion can be planted from sets in the autumn and will produce excellent early green onions. This type of onion is peculiar in that a large onion contains a number of distinct hearts, and if planted will produce a number of small onions. On the other hand, a small onion contains but one heart and will produce a large onion.

A few large onions should be planted each year to produce the sets for the following year's planting.

Another variety is the Top or Tree onion, which produces a large number of bulblets above ground on the top of a stem. The small bulbs can be planted in the autumn and will produce onions the following season.

The small onion, known as the shallot, is frequently planted in early spring for its small bulbs, or "cloves," which are used in the same manner as onions. The leaves are also used for flavoring.

The cibol or Welsh onion is grown either from seeds or bulbs. Where the climate is not severe, the seed may be sown in the autumn, and the leaves, which are used for flavoring soups, will be ready for use in the spring.

For additional information on the onion, see Farmers' Bulletin No. 39, entitled "Onion Culture."

Oyster-plant (See Salsify)

Parsley

After soaking the seeds of parsley for a few hours in warm water, they may be sown in the same manner as celery seed and the plants transplanted to the open ground. At the North, parsley will live over winter in a cold frame or pit, and in the South it will thrive in the open ground during the winter, but it can not withstand the heat of summer. The plants should be set in rows 12 inches apart and every 4 inches in the row.

The leaves of parsley are used for garnishings around meats and for flavoring soups.

Parsnip

Sow the seeds of parsnips as early as convenient in the spring in drills 18 inches to 3 feet apart. Thin the plants to stand 3 inches apart in the rows. The parsnip requires a rich soil and frequent cultivation. The roots can be dug late in the fall and stored in cellars or pits, or allowed to remain where grown and dug as required for use. It is considered best to allow the roots to become frozen in the ground, as the freezing improves their flavor. As soon as the roots begin to grow the following spring they will no longer be fit for use. All roots not used during the winter should be dug and removed from the garden, as they will produce seed the second season and become of a weedy nature. When the parsnip has been allowed to run wild the root is considered to be poisonous.

To prepare parsnip for the table, boil the roots until tender and then cut in slices and brown in butter. They may also be roasted with meat the same as potatoes.

Peas

Garden peas require a rather rich and friable soil with good drainage in order that the first plantings may be made early in the spring. Fertilizers that are high in nitrogenous matter should not be applied to the land immediately before planting, as they will have a tendency to produce too great growth of vines at the expense of pods. Land that has been well manured the previous year will be found satisfactory without additional fertilizer. A sandy loam is to be preferred for growing peas, but a good crop may be produced on clay soils; however, the pods will be a few days later

in forming. Peas are easily grown and form one of the most palatable of garden products.

The first plantings should be of such varieties as Alaska or Gradus, which make a small but quick growth, and may or may not be provided with supports. The dwarf sorts like American Wonder come on later, require very little care, and produce peas of fine quality. The tall-growing sorts of the Telephone type are desirable for still later use on account of their large production and excellent quality. Sugar peas have tender pods and if gathered very young the pods may be eaten in the same manner as snap beans. In order to maintain a continuous supply of fresh peas, plantings should be made every 10 days or 2 weeks during the spring months, beginning as soon as the ground can be worked. In the extreme South peas may be grown during the entire winter.

For the best results peas should be planted in the bottom of a furrow 6 inches in depth and the seeds covered with not more than 2 or 3 inches of soil. If the soil is heavy, the covering should be less than 2 inches. After the plants attain a height of 4 or 5 inches the soil should be worked in around them until the trench is filled. The rows for peas should be 3 feet apart for the dwarf sorts and 4 feet apart for the tall kinds. A pint of seed will plant about 100 feet of single row. Many growers follow the practice of planting in a double row with a 6-inch space between. The double-row method is especially adapted for the varieties that require some form of support, as a trellis can be placed between the two rows.

Brush stuck in the ground will answer for a support for the peas to climb upon. Three-foot poultry netting makes a desirable trellis. If peas are planted for

autumn use, the earliest varieties should be employed.

Peppers

Plant the seed of peppers in a hotbed, and transplant to the open ground as soon as it is warm, or sow the seeds in the garden after all danger of frost is past. When grown in the garden, the plants should be in rows 3 feet apart and 15 to 18 inches apart in the row. The plants require about the same treatment as the tomato. There are a large number of varieties of the pepper, including the large sweet sorts used for pickling and the small hot kinds, such as Chili, Tabasco, and Cayenne.

Peppergrass (See Cress)

Physalis

The physalis is also known as the ground-cherry or husk-tomato. Sow the seed in a hotbed or cold frame and transplant to the garden after danger of frost is past, or the seeds may be sown in the row where the plants are to remain and thinned to 12 or 18 inches. No particular care is required except to keep them free from weeds. There are a large number of varieties of the physalis, and the fruits vary in size and color. The variety commonly used in gardens produces a bright-yellow fruit, which is about the size of an ordinary cherry. Toward fall the fruits will drop to the ground and will be protected for some time by their husks. If gathered and placed in a cool place the fruits will keep for a long time. The physalis will self-sow and may become a weed, but it is easily controlled. A few of the volunteer plants may be lifted in the spring, and placed in rows instead of making a special sowing

of seed. Ten plants will produce all the husk-tomatoes desired by the average family. The fruits are excellent for making preserves and marmalade.

Pie-plant (See Rhubarb)

Potato, Irish

A rich, sandy loam is best suited to the production of Irish potatoes, and the fertilizers employed should contain high percentages of potash. The main crop of Irish potatoes for family use should be grown elsewhere, but a small area of early ones properly belongs in the garden. The preparation of the soil should be the same as for general garden crops.

Early potatoes should be planted as early in the spring as it is feasible to work the land, irrespective of locality. This will require planting in January in the extreme Southern States, and as late as May in the extreme Northern States. Late potatoes are extensively grown in the North, and the planting should be done late in May or during June. The rows should be 2½ to 3 feet apart, and the hills 14 to 18 inches apart in the row. Lay off the rows with a one-horse plow or lister, and drop the seed, one or two pieces in a place, in the bottom of the furrow. Cover the seed to a depth of about 4 inches, using a hoe or a one-horse plow for the purpose. One to three weeks will be required for the potatoes to come up, depending entirely upon the temperature of the soil. The ground may freeze slightly after the planting has been done, but so long as the frost does not reach the seed potatoes no harm will result, and growth will begin as soon as the soil becomes sufficiently warm.

As soon as the potatoes appear above the ground and the rows can be followed, the surface soil should be

well stirred by means of one of the harrow-toothed cultivators. Good cultivation should be maintained throughout the growing season, with occasional hand hoeing, if necessary, to keep the ground free from weeds. Toward the last the soil may be well worked up around the plants to hold them erect and protect the tubers from the sun after the vines begin to die.

After digging the potatoes they should not be allowed to lie exposed to the sun or to any light while in storage, as they soon become green and unfit for table use. Early potatoes especially should not be stored in a damp place during the heated part of the summer, and will keep best if covered with straw in a cool, shady shed until the autumn weather sets in, after which they can be placed in a dry cellar or buried in the open ground. The ideal temperature for keeping Irish potatoes is between 36° and 40° F., but they will not withstand any freezing.

Potato Onion (See Onion)

Potato, Sweet

The sweet potato is of a tropical nature and succeeds best in the warm, sandy loam soils of the Southern States. Sweet potatoes are, however, grown commercially as far north as the southern line of the State of Pennsylvania, and for family use even in southern New York and Michigan. A warm, loose sandy soil is best adapted to the production of sweet potatoes, and good drainage is essential. In order to improve the drainage conditions, it is customary to set the plants on top of ridges which are thrown up by means of a plow, two furrows being turned together. For best results the soil should be well fertilized throughout, but in com-

mercial sweet potato culture the plan is frequently adopted of placing the fertilizer or manure in a furrow and then turning the ridge up over it. The manure should be evenly distributed, and it is advisable to run a cultivator once or twice in the furrow to mix the manure with the soil. Too much manure in one spot under the hill will produce a large growth of vine at the expense of the potatoes.

Toward the northern part of the area over which sweet potatoes are grown it is necessary to start the plants in a hotbed in order that the length of season may be sufficient to mature the crop. The roots that are too small for marketing are used for seed, and these are bedded close together in the hotbed and covered with about 2 inches of sand or fine soil, such as leaf mold. The seed should be bedded about 5 or 6 weeks before it will be safe to set the plants in the open ground, which is usually about May 15 or May 20. Toward the last the hotbed should be ventilated very freely in order to harden off the plants.

The ridges for planting sweet potatoes should be 3 to 5 feet apart and the plants about 14 inches apart in the row. Cultivate sufficiently to keep the surface soil loose and free from weeds, and the vines will soon cover the ground, after which no cultivation will be necessary. In the warmer parts of the country the seed is not bedded, but is cut in small pieces and planted in the ridges instead of plants. After the plants come up and begin to make vines freely, pieces of the vines are removed and used as cuttings for planting additional areas, the cuttings taking root and growing the same as plants grown from seed. In this manner 3 and 4 plantings are made, the last being as late as the middle of July. If a rainy spell be selected for making

and planting the cuttings, very few will fail to grow, and an excellent crop may be produced.

To the north, sweet potatoes are dug as soon as the vines are nipped by frost. In the South the potatoes are allowed to remain in the ground until a convenient time for handling them, and in Florida or Texas they are frequently left until required for use. Sweet potatoes should be dug on a bright, drying day when the soil is not too wet. On a small scale they may be dug with a spading fork, and great care should be taken that the roots do not become bruised or injured in the process of handling. It is desirable that the roots should lie exposed for 2 or 3 hours to dry thoroughly, after which they may be placed in a warm, well ventilated room to cure for several days. The proper temperature for curing sweet potatoes is from 80° to 90° F. and 45° or 55° F. afterwards. A small crop may be cured around the kitchen stove, and later stored in a dry room where there will be no danger of their becoming too cold. Sweet potatoes should be handled as little as possible, especially after they have been cured.

Sweet potatoes are used the same as Irish potatoes, and may also be employed in making pies the same as squash. For further information the reader should obtain Farmers' Bulletin No. 129, entitled "Sweet Potatoes."

Pumpkin

The true pumpkin is hardly to be considered as a garden crop, and, as a rule, should be planted among the field corn. Plant where the hills of corn are missing and cultivate with the corn.

Radish

The radish is quite hardy and may be grown throughout the winter in hotbeds at the North, in cold frames in the latitude of Washington, and in the open ground in the South. For the home garden the seed should be sown in the open ground as soon as the soil is moderately warm. Plant in drills 12 to 18 inches apart, and as soon as the plants are up, thin them slightly to prevent crowding. Radishes require to be grown on a quick, rich soil, and some of the earlier sorts can be matured in 2 to 3 weeks after planting. If the radishes grow slowly they will have a pungent flavor and will not be fit for table use. For a constant supply successive plantings should be made every 2 weeks, as the roots lose their crispness and delicate flavor if allowed to remain long in the open ground. As a rule a large percentage of radish seed will grow, and it is often possible by careful sowing to avoid the necessity of thinning, the first radishes being pulled as soon as they are of sufficient size for table use, thus making room for those that are a little later. Radishes will not endure hot weather and are suited to early spring and late autumn planting.

There are a number of varieties of winter radishes, the seed of which may be planted the latter part of summer and the roots pulled and stored for winter use. These roots should remain in the ground as long as possible without frosting and should then be dug and stored the same as turnips. This type of radish will not compare with the earlier summer varieties, which may be easily grown in a hotbed or cold frame during the winter. One ounce of radish seed is sufficient to plant 100 feet of row, and when grown on a large

scale 10 to 12 pounds of seed will be required to the acre.

Rhubarb

The soil for rhubard should be deep, and there is little danger of having it too rich. Like asparagus the seedling plants of rhubarb can be grown and transplanted. Ten to twelve good hills are sufficient to produce all the rhubard required by the average family, and these are most easily established by planting pieces of roots taken from another bed. Good roots may be secured from dealers and seedsmen at about $1.50 a dozen. The old hills may be divided in the early spring or late fall by digging away the earth on one side and cutting the hill in two with a sharp spade, the part removed being used to establish a new hill.

The usual method of planting rhubarb is to set the plants in a single row along the garden fence, and the hills should be about 4 feet apart. If more than one row is planted the hills should be 3½ or 4 feet each way. The thick leaf stems are the part used, and none should be pulled from the plants the first year after setting. Rhubarb should receive the same treatment during winter as asparagus, and the plants should never be allowed to ripen seed. The roots may be brought into the greenhouse, pit, cold frame, or cellar during the winter and forced. Rhubarb does not thrive in warm climates.

The use of rhubarb is principally during the early spring for making pies and sauces, and the stems may be canned for winter use.

Ruta-baga

The culture of the ruta-baga is the same as for the turnip, except that the former requires more room and a

longer period for its growth. The roots are quite hardy and will withstand considerable frost. The rutabaga is used like the turnip, and also for stock feed. Two pounds of seed are required for one acre.

Salad Chervil (See Chervil)

Salsify, or Vegetable Oyster

Sow seeds of salsify during the spring in the same manner as for parsnips or carrots. At the South, a sowing may be made in summer to produce roots for winter use. One ounce of seed is required to plant 100 feet of row, and on a large scale 10 pounds to the acre. After the plants are well established they should be thinned sufficiently to prevent their crowding. The cultivation should be the same as for parsnips or carrots, and frequent use of a wheel hoe will avoid the necessity for hand weeding. Salsify may be dug in the autumn and stored or allowed to remain in the ground during the winter, as its treatment is the same as for parsnips. Salsify is a biennial, and if the roots are not dug before the second season they will throw up stems and produce seed. It is of a weedy nature and care should be taken that it does run wild by seeding freely.

Salsify is deserving of more general cultivation, as it is one of the more desirable of the root crops for the garden. The uses of salsify are similar to those of the parsnip, and when boiled and afterwards coated with rolled crackers and fried in butter it has a decided oyster flavor, from which the name vegetable oyster is derived.

Scallion (See Onion)

Shallot (See Onion)

Spinach

Spinach thrives in a rather cool climate and attains its best development in the Middle South, where it can be grown in the open ground during the winter. Large areas of spinach are grown near Norfolk, Va., cuttings being made at any time during the winter when the fields are not frozen or covered with snow. When the weather moderates in the early spring, the plants make a new growth, and a large crop of early greens is available. North of the latitude of Norfolk, spinach can be planted in the autumn and carried over winter by mulching with straw or leaves. Sow the seeds of spinach in drills 1 foot apart at the rate of 1 ounce to 100 feet of row or 10 to 12 pounds to the acre. To produce good spinach, a rich loam which will give the plants a quick growth is required. As ordinarily grown, spinach occupies the land during the autumn and winter only and does not interfere with summer cultivation.

Spinach is an easily grown garden crop, and there is, perhaps, no other of its kind that will give as good satisfaction. Three or four ounces of seed, planted in the autumn after a summer crop has been harvested from the land, will produce an abundance of greens for the average family during the late autumn and early spring. In gathering spinach the entire plant is removed rather than merely cutting off the leaves. The larger plants are selected first, and the smaller or later ones are thus given room to develop. No thinning is required if this plan of harvesting is practiced.

Squash

There are two types of the squash, the bush varieties, which may be planted in hills 4 or 5 feet apart

each way, and the running varieties, which will require from 8 to 16 feet for their development. Squashes may properly be grown in the garden, as 3 or 4 hills will produce all that are required for family use. They require practically the same soil and cultural methods as the muskmelon. A number of varieties are used during the summer in the same manner as vegetable marrow, but squashes are principally used during the winter, in much the same way as pumpkins, to which they are superior in many respects. Squashes are also used extensively for pie purposes. The varieties known as Hubbard and Boston Marrow are most commonly grown.

Squashes, like pumpkins, should be handled carefully to avoid bruising, and should be stored in a moderately warm but well ventilated room.

Sweet Potato (See Potato, Sweet)

Sweet Corn (See Corn, Sweet)

Tomato

At the North it is very desirable to start tomato plants in a house or in a hotbed, and transplant once or twice in order to secure strong, vigorous plants by the time all danger from frost has passed. In the South the plants are started in cold frames or in beds in the open ground and protected by cotton cloth during the cool weather. In the southern parts of Florida and Texas large fields of tomatoes are planted in the same manner as corn, by placing five or six seeds in a hill where the plants are to be grown. After the seedlings become established, all but the two best are thinned out, and later but one is left in the hill.

The tomato is one of the crops that can be hastened

to maturity by carefully growing the plants indoors and transplanting to the open ground. Pot-grown plants are especially desirable, and they may be brought to the blooming period by the time it is warm enough to plant them safely in the garden. If the plants are not to be trained, but allowed to lie on the ground, they should be set about 4 feet apart each way. If trimmed and tied to stakes, they may be planted in rows 3 feet apart, and 18 inches apart in the row.

The tomato is one of the American vegetables that have come into general use during the past half century and it now forms one of the most important of our garden crops. The uses of the tomato are too numerous and too well known to require attention here. For complete information regarding this vegetable, read Farmers' Bulletin No. 220, entitled "Tomatoes."

Top Onion (See Onion)

Tree Onion (See Onion)

Turnip

The turnip requires a rich soil, and may be grown either as an early or a late crop. For an early crop, sow the seeds in drills 12 to 18 inches apart as early in the spring as the condition of the soil will permit. Two pounds of seed are required to plant an acre. After the plants appear, thin to about 3 inches. The roots will be ready for use before hot weather. For late turnips the seeds are usually sown broadcast on land from which some early crop has been removed, generally during July or August, but later in the South. Turnips are quite hardy and the roots need not be gathered until after several frosts. Turnips may be stored in a cellar or buried in a pit outside. Before storing, the tops should be removed.

GARDENER'S PLANTING TABLE

Quantity of seeds or number of plants required for a row 100 feet in length, with distances to plant, times for planting, and period required for production of crop.

Brackets indicate that a late or second crop may be planted the same season.

Kind of Vegetable.	Seeds or Plants Required for 100 Feet of Row.	Distance for Plants to Stand.			Depth of Planting.	Time of Planting in Open Ground.		Ready for Use after Planting.
		Rows Apart.		Plants Apart in Rows.		South.	North.	
		Horse Cultivation.	Hand Cultivation.					
Artichoke, Globe	½ ounce	3–4 ft	2–3 ft	2–3 ft	1–2 in	Spring	Early spring	15 months.
Artichoke, Jerusalem.	2 qts. tubers	3–4 ft	1–2 ft	1–2 ft	2–3 in	Spring	Early spring	6–8 months.
Asparagus, seed	1 ounce	30–36 in.	1–2 ft	3–5 in	1–2 in	Autumn or early spring	Early spring	3–4 years.
Asparagus, plants	60–80 plants	3–5 ft	12–24 in.	15–20 in	3–5 in	Autumn or early spring	Early spring	1–3 years.
Beans, bush	1 pint	30–36 in.	18–24 in.	5 or 8 to ft	½–2 in	February to April. [August to September.]	April to July	40–65 days.
Beans, pole	½ pint	3–4 ft	3–4 ft	3–4 ft	1–2 in	Late spring	May and June	50–80 days.
Beets	2 ounces	24–36 in.	12–18 in.	5 or 6 to ft	1–2 in	February to April. [August to September.]	April to August	60–80 days.
Brussels sprouts	¼ ounce	30–36 in.	24–30 in.	16–24 in	½ in	January to July	May and June	90–120 days.
Cabbage, early	¼ ounce	30–36 in.	24–30 in.	12–18 in	½ in	October to December	March and April. (Start in hotbed during February.)	90–130 days.
Cabbage, late	¼ ounce	30–40 in.	24–36 in.	16–24 in	½ in	June and July	May and June	90–130 days.
Cardoon	½ ounce	3 ft	2 ft	12–18 in	1–2 in	Early spring	April and May	5–6 months.
Carrot	1 ounce	30–36 in.	18–24 in.	6 or 7 to ft	½ in	March and April. [September.]	April to June	75–110 days.
Cauliflower	¼ ounce	30–36 in.	24–30 in.	14–18 in	½ in	January and February. June.]	April to June. (Start in hotbed during February or March.)	100–130 days.
Celeriac	¼ ounce	30–36 in.	18–24 in.	4 or 5 to ft	⅛ in	Late spring	May and June. (Start in cold frame during April.)	100–150 days.
Celery	¼ ounce	3–6 ft	18–36 in.	4–8 in	⅛ in	August to October	May and June. (Start in hotbed or cold frame during March or April.)	120–150 days
Chervil	1 ounce	30–36 in.	18–24 in.	3 or 4 to ft	1 in	Autumn	Autumn	1 year.
Chicory	¼ ounce	30–36 in.	18–24 in.	4 or 5 to ft	½ in	March and April	May and June	5–6 months.
Citron	1 ounce	8–10 ft	8–10 ft	8–10 ft	1–2 in	March and April	May and June	100–130 days.
Collards	¼ ounce	30–36 in.	24–30 in.	14–18 in	½ in	May and June	Late spring	100–120 days.
Corn salad	2 ounces	30 in	12–18 in.	5 or 6 to ft	½–1 in	January and February [Sept. and Oct.]	March to September	60 days.
Corn, sweet	¼ pint	36–42 in.	30–36 in.	30–36 in	1–2 in.	February to April	May to July	60–100 days.
Cress, upland	½ ounce	30 in	12–18 in.	4 or 5 to ft	½–1 in	January and February. [Autumn.]	March to May. [September.]	30–40 days.
Cress, water	⅓ ounce	Broadcast			On surface	Early spring	April to September	60–70 days.

Cucumber	½ ounce	4–6 ft.	4–6 ft.	4–6 ft.	1–2 in.	February and March. [September.]	April to July	60–80 days.
Dandelion	¼ ounce	30 in.	18–24 in.	8–12 in.	½ in.	Early spring or autumn	Early spring	6–12 months.
Eggplant	⅛ ounce	30–36 in.	24–30 in.	18–24 in.	½–1 in.	February to April	April and May. (Start in hotbed during March.)	100–140 days.
Endive	1 ounce	30 in.	18 in.	8–12 in.	½–1 in.	February to April	April. [July.]	90–180 days.
Horse-radish	70 roots	30–40 in.	24–30 in.	14–20 in.	3–4 in.	Early spring	Early spring	1–2 years.
Kale, or borecole	¼ ounce	30–36 in.	18–24 in.	18–24 in.	½ in.	October to February	August and September. [March and April.]	90–120 days.
Kohl-rabi	¼ ounce	30–36 in.	18–24 in.	4–8 in.	½ in.	September to March	March to May	60–80 days.
Leek	½ ounce	30–36 in.	14–20 in.	4–8 in.	1 in.	May to September	March to May	120–180 days.
Lettuce	½ ounce	30 in.	12–18 in.	4–6 in.	½ in.	September to March	March to September	60–90 days.
Melon, muskmelon	½ ounce	6–8 ft.	6–8 ft.	Hills 6 ft.	1–2 in.	February to April	April to June. (Start early plants in hotbed during March.)	120–150 days.
Melon, watermelon	1 ounce	8–12 ft.	8–12 ft.	Hills 10 ft.	1–2 in.	March to May	May and June	100–120 days.
Mustard	¼ ounce	30–36 in.	12–18 in.	4 or 5 to ft.	¼ in.	Autumn or early spring	March to May. [Sept.]	60–90 days.
New Zealand spinach	1 ounce	36 in.	24–36 in.	12–18 in.	1–2 in.	Early spring	Early spring	60–100 days.
Okra, or gumbo	2 ounces	4–5 ft.	3–4 ft.	24–30 in.	1–2 in.	February to April	May and June	90–140 days.
Onion, seed	1 ounce	24–36 in.	12–18 in.	4 or 5 to ft.	½–1 in.	October to March	April and May	130–150 days.
Onion, sets	1 qt. of sets	24–36 in.	12–18 in.	4 or 5 to ft.	1–2 in.	Early spring	Autumn and February to May.	90–120 days.
Parsley	¼ ounce	24–36 in.	12–18 in.	3–6 in.	⅛ in.	September to May	September and early spring.	90–120 days.
Parsnip	½ ounce	30–36 in.	18–24 in.	5 or 6 to ft.	½–1 in.	....	April and May	125–160 days.
Peas	1–2 pints	3–4 ft.	30–36 in.	15 to ft.	2–3 in.	September to April	March to June	40–80 days.
Pepper	⅛ ounce	30–36 in.	18–24 in.	15–18 in.	½ in.	Early spring	May and June. (Start early plants in hotbed during March.)	100–140 days.
Physalis	½ ounce	30–36 in.	18–24 in.	18–24 in.	½ in.	March to May	May and June	130–160 days.
Potato, Irish	5 lb. (or 9 bu. per acre).	30–36 in.	24–36 in.	14–18 in.	4 in.	January to April	March to June	80–140 days.
Potato, sweet	3 lb. (or 75 slips).	3–5 ft.	3–5 ft.	14 in.	3 in.	April and May	May and June. (Start plants in hotbed during April.)	140–160 days.
Pumpkin	½ ounce	8–12 ft.	8–12 ft.	Hills 8 to 12 ft.	1–2 in.	April and May	May to July	100–140 days.
Radish	1 ounce	24–36 in.	12–18 in.	8–12 to ft.	½–1 in.	September to April	March to September	20–40 days.
Rhubarb, seed	½ ounce	36 in.	30–36 in.	6–8 in.	½–1 in.	....	Early spring	2–4 years.
Rhubarb, plants	33 plants	3–5 ft.	3–5 ft.	3 ft.	2–3 in.	....	Autumn or early spring	1–3 years.
Ruta-baga	¼ ounce	30–36 in.	18–24 in.	6–8 in.	½–1 in.	August and September	May and June	60–80 days.
Salsify	1 ounce	30–36 in.	18–24 in.	2–4 in.	½–1 in.	....	Early spring	120–180 days.
Spinach	1 ounce	30–36 in.	12–18 in.	7 or 8 to ft.	1–2 in.	September to February.	September or very early spring.	30–60 days.
Squash, bush	½ ounce	3–4 ft.	3–4 ft.	Hills 3 to 4 ft.	1–2 in.	Spring	April to June	60–80 days.
Squash, late	½ ounce	7–10 ft.	7–10 ft.	Hills 7 to 9 ft.	1–2 in.	Spring	April to June	120–160 days.
Tomato	½ ounce	3–5 ft.	3–4 ft.	3 ft.	½–1 in.	December to March	May and June. (Start early plants in hotbed during February and March.)	100–140 days.
Turnip	½ ounce	24–36 in.	18–24 in.	6 or 7 to ft.	¼–½ in.	August to October	April. [July.]	60–80 days.
Vegetable marrow	½ ounce	8–12 ft.	8–12 ft.	Hills 8 to 9 ft.	1–2 in.	Spring	April to June	110–140 days.

Turnips are used in pot-boiled preparations with potatoes, cabbage, and meat, or are boiled with pork, or mashed like potatoes.

Turnip-rooted Chervil (See Chervil)

Vegetable Marrow

The so-called vegetable marrows are closely allied to the pumpkin, both as to species and habit of growth, the principal difference being that the vegetable marrows are used while quite young and tender, and may be baked and served very much the same as sweet potatoes. The vegetable marrows should receive thorough cultivation in order that a tender product may be secured, and should be gathered while the outside skin is still so tender that it may easily be broken by the finger nail. The flesh is either boiled and mashed or baked in the oven and served with butter while hot.

Vegetable Oyster (See Salsify)

Water Cress (See Cress)

Watermelon (See Melon—Watermelon)

Welsh Onion (See Onion)

Witloof (See Chicory)

U. S. DEPARTMENT OF AGRICULTURE
FARMERS' BULLETIN NO. 853

HOME CANNING OF FRUITS AND VEGETABLES

AS TAUGHT TO CANNING CLUB MEMBERS IN THE SOUTHERN STATES

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INTRODUCTION

Canning has become the most widely used and popular means of preserving large quantities of fruits and vegetables. The original form, flavor, color, and texture of fruits and succulent vegetables are retained to a greater degree by canning than by any other means. For this reason, certain delicately flavored vegetables are most attractive when canned. Another advantage is that canned foods are ready for almost immediate serving. It must be remembered that other means of preserving foods are very desirable, especially during the present season when conservation of all food products should be practiced. For example, legumes, like lima beans and peas, and root crops, like carrots and beets, while attractive when canned

in a succulent stage, are more nutritious and more economically stored when mature. Summer cabbage, cauliflower, and cucumbers are better saved in brine than canned. Other vegetables also can be brined. Many vegetables, such as sweet corn and green string beans, can be dried, and in this stage furnish variety and serve as a substitute for canned vegetables. If properly dried and stored these vegetables are attractive and wholesome. A publication (Farmers' Bul. 841) dealing with drying may be obtained from the United States Department of Agriculture.

This bulletin will deal wholly with methods for canning, preserving, and jelly making. The directions given are chiefly for those products which seem most worth preserving in these ways, and the methods are those which seem best suited to the products.

Sterilization

Cause of Spoilage

Foods decompose or spoil because they are attacked by living germs, minute forms of plant life of the lowest order. Three types of these tiny organisms cause foods to spoil, namely, molds, yeasts, and bacteria. These are present constantly everywhere, in air, water, and soil, and on food. All except molds are so minute as to be invisible without the aid of a microscope, and all exist in teeming millions.

Molds are of first interest because the housekeeper is familiar with their appearance in the growing stage in which they attack foods, and even fabrics, causing rapid destruction. Molds thrive in dampness and darkness and prefer freedom from currents of air. They require oxygen, moisture, and warmth, and feed upon

sugar and starches. Since they can grow in the presence of acids, fruit and tomatoes are readily attacked by them. The fruiting parts of molds bear spores which serve the same purpose as seeds of higher plants. These invisible spores are produced in such quantities as to be present in the air at all times, ready to develop upon any foods which are exposed. Molds are killed easily by moist heat. The practice of sterilizing foods in jars and sealing immediately eliminates all trouble with mold.

Yeasts also must be controlled in canning. Yeasts are of many kinds, all one-celled plants, which reproduce by budding, that is, by the growth of a bud on the edge of a cell. This bud quickly becomes full grown and breaks away from the mother cell. Some yeasts have another means of reproduction, that is, by the production of spores within the cell.

The use of yeast in bread making is familiar. When supplied with food (in the form of sugar), warmth, moisture, and air, yeasts grow, breaking up the sugar and producing alcohol and a gas called carbon dioxid. Bubbles of this gas are seen when canned fruits ferment. Since yeasts are abundant in the air and on the surface of fruits and vegetables, it is always necessary to destroy them on food being canned, to seal containers air-tight, and to prevent further entrance of these organisms into the canned foods. Yeasts usually are killed by moist heat at 190° F. (simmering).

Bacteria are much more difficult to destroy than molds and yeasts and are the chief foe to combat in all preserving of foods. They also are one-celled plants, smaller than yeasts, and usually reproduce by division. So rapid is this reproduction that a single bacterium may produce millions more in a few hours. Bacteria

require for their growth warmth, moisture, and food. Certain species of bacteria thrive without air. Since few bacteria thrive in acids or in the presence of much ugar, their destruction is less difficult in fruits and tomatoes than in such vegetables as corn, peas, and beans or in meats, which are the most difficult of all foods to can safely.

Bacteria in their active growing state can be killed by subjecting them to moist heat at boiling temperature for different lengths of time. Unfortunately for the canner many kinds of bacteria have the power under adverse conditions of producing spores, which are much more resistant to heat than are the growing stages. These spores may be compared to the seeds of higher plants in their ability to withstand adverse conditions. It is known that some spores are able to resist boiling temperature for hours. All bacteria in the spore state can be destroyed by subjecting them to a temperature of 240° to 250° F., moist heat. This temperature can be secured only with steam under pressure. Almost all the bacteria which are so resistant to heat when in the spore state are abundant in cultivated soil, and therefore present upon the pods and husks of such vegetables as corn, peas, and beans, which contain the food upon which the spore-bearing forms thrive. The presence of these bacteria upon the parts of vegetables to be canned, therefore, is almost inevitable. The difficulty of sterilization is increasingly great when such vegetables have been bruised or allowed to stand, or have among them decayed portions.

Enzyms. Fruits and vegetables, after being gathered, undergo natural changes which cause staleness and injure the quality. These changes take place

with varying rapidity in different foods and are due to the action of substances known as enzyms, which have the power to cause ripening and other changes. The delicate flavors of many fruits are thus destroyed when they are allowed to stand too long before being canned.

Methods of Sterilization

The term sterilization, when applied to canning, is used to cover the process of inclosing the food in cans or jars which afterwards can be sealed air-tight, and subjecting it to sufficient heat to kill all living organisms. To be effective, sterilization must be followed immediately by sealing the containers air-tight to prevent further entrance of molds, yeasts, or bacteria.

Formerly a common household practice in canning (applied chiefly to fruits and tomatoes) consisted in cooking the material to be canned in an open kettle, transferring it, while boiling hot, to hot sterilized jars, and at once sealing with a lid which also had been sterilized. That this practice is uncertain is shown by the frequency with which a growth of mold appeared on the fruit canned in this way, causing loss. This method is objectionable not only because it so frequently results in insufficient sterilization, but also because it gives a product of inferior quality. Its use is also attended by discomfort and inconvenience to the housekeeper who is forced to do most of the work indoors over a hot stove. Moreover, with the exception of tomatoes, vegetables can not be canned by this method with the certainty that they will keep. For these reasons sterilization of fruits and vegetables after being packed in containers has largely superseded the open-kettle method.

Since certain vegetables are frequently attacked by spore-bearing bacteria, a longer period of sterilization at boiling temperature is required for them than for fruits. Often they are sterilized by boiling 3 to 5 hours. The spores of some species of bacteria have been known to resist even 5 hours' boiling. Since this gives a chance for failure, the laboratory practice of intermittent or fractional sterilization is applied to household canning when a hot-water canner is used for processing certain vegetables. Intermittent sterilization consists of applying boiling temperature to vegetables already packed in containers for a period on each of three successive days, sealing the jar immediately after each boiling or "processing" if the lid has been loosened to allow for the expansion caused by heat. After each daily processing the containers are kept at ordinary temperature, under which the spores not killed by boiling develop into bacteria of the easily-killed vegetative or growing state, which are then destroyed by the next period of boiling. Rarely do any spores fail thus to develop and be destroyed by the third processing. Processing for 1 hour in a water bath at boiling temperature on the first day, repeated on the second and third days, will ordinarily sterilize beans, peas, and corn in quart jars, if these vegetables are selected properly and handled carefully. The flavor of vegetables thus processed is finer than when they are subjected to high temperatures. This is the safest method to follow with hot-water canners. When a steam-pressure outfit is used, a higher temperature can be obtained and the period of sterilization shortened, at the same time eliminating the uncertainty of securing complete sterilization.

Aids to Sterilization

The first essential for complete sterilization with the use of either the hot-water canner or the steam-pressure outfit is absolute cleanliness in surroundings and in all utensils used in canning. Tables should be well cleaned and may be covered with white oilcloth. Garbage cans must be provided to hold peelings and other refuse. To allow these to fall upon the ground to decay near the place of canning will result in production of spores which will rise in dust and infect the material being canned.

Greater safety will follow if containers and lids are sterilized by boiling for 15 minutes after being washed thoroughly. They should then be inverted on a clean surface until used. Cleanse rubbers by dropping for a minute into a boiling solution of soda and water (1 quart of water to 1 teaspoonful soda), removing from fire at once to prevent injury to them.

Testing the Seal

After fruits and vegetables are canned and set aside for 24 hours, lightning seal or hermetic jars may be tested by raising the clamp and attempting to lift the jar by the lid. If the lid comes off, the jar is either not sealed or the food is fermenting. If the lid remains tight, the chances are that its contents are keeping. Screw-top jars may be tested by simply inverting to see if there is any leak. Test all jars, so that when faulty sealing alone exists, jars may be reprocessed and contents saved. If the food is fermenting it should be discarded. However, the tight seal is not always an indication that the food is keeping. Some foods are often attacked by bacteria, which thrive without

the presence of air, and which decompose canned foods without producing any gas. When these have not been killed by processing, the food may appear good and the jar remain sealed yet the contents be unfit for use. In tin these spoils are known as "flat sours" because the can is not bulged and shows no indication of spoiling. This kind of failure is more often due to canning stale vegetables. Fibers of stale vegetables become tough and heat will not penetrate them so easily. Therefore the period for sterilization should be lengthened.

Very often plants absorb from the soil or from fertilizers certain minerals that have a tendency to make the fibers of the plant more resistant to heat, thereby necessitating a longer period of sterilization in order to destroy all spores present.

Equipment for Canning in the Home

When canning in small quantities, it is not necessary to purchase special equipment, although inexpensive portable equipment for use in or out of doors may be purchased. If considerable canning is done, such outfits will prove convenient and save labor. Especially is this true when a comfortable out-of-door place can be selected for the work.

The method of packing fruits and vegetables into containers and sterilizing the product after it is packed has superseded to a very large extent the old plan of cooking the food in an open kettle, transferring it hot to the jar, and sealing without any further sterilization. Since this is true, the first consideration is a sterilizing vessel. This is sometimes called a processor. Cooking the food in the jar to sterilize it is known as

processing. This cooker must be large enough to hold a convenient number of packed jars and must be fitted with a false bottom and a tight cover. A wash boiler, bucket, or galvanized tub can be used for a processor. It may be used on the kitchen stove or placed on a furnace built out of doors. One important factor is to be able to bring the water in this cooker quickly to the boiling point and maintain this temperature steadily. The false bottom is a rack which keeps the jars from coming in contact with the metal which is next to the frame. This prevents breakage. Racks made of strips of wood are probably the best. Sometimes wire netting, or perforated galvanized trays, are used. If the latter material is used, it should be raised about 1 inch or 2 inches above the bottom of the vessel.

Types of Canners

Hot-water Canner. Several convenient types of portable canners are on the market. The simplest hot-water outfit is one to be placed on the kitchen stove. Another, more complete, has a fire box attached and is used out of doors. These outfits also include blanching trays, tongs for handling hot jars, a false bottom, and tools necessary for sealing tin cans. The canner which has been described is commonly known as a water-bath canner.

The type of canner should be chosen with reference to the kind and amount of canning to be done. The small hot-water canner is the least expensive of the commercial outfits for home canning. For inexperienced people it is also more easily handled. This type of canner is preferable for processing fruits and tomatoes. They are sterilized easily at boiling tem-

perature and the texture, flavor, and color of the finished products, processed at this temperature, are superior to those which have been subjected to the higher temperatures.

Water-seal Canner. Another type of canner is known as the water seal. The advantages of this type of canner are that only a small quantity of water is needed and it can be raised quickly to the boiling point with the use of very little fuel. A steady temperature also can be maintained easily. When the lid is in place a slight pressure is secured and this makes it possible to maintain a temperature 2° or 3° higher than the boiling point.

In this bulletin no separate time-table for processing in the water-seal canner is given, because the difference in temperature obtained in the two types of canner is not sufficient to warrant a close distinction in length of processing periods.

Steam-pressure Canner. The steam canner is constructed out of strong material and provided with a tightly fitting lid, which when clamped in place makes it possible to hold steam under pressure and obtain a correspondingly high temperature. It has a steam gauge and thermometer attached to the lid. These attachments register the temperature and the corresponding number of pounds pressure. Since the steam canner is made of very heavy material, a greater degree of heat is required to bring up the temperature quickly.

When large quantities of vegetables such as beans, peas, corn, etc., are to be canned, much time, labor, and fuel can be saved if the steam-pressure outfit is used. These vegetables, if processed in a water bath, need to be cooked either continuously for a long period

or intermittently. When a higher temperature is retained during the processing, the length of time may be considerably shortened.

Convenient Utensils

Whether a homemade or commercial canner is used it is necessary to assemble certain utensils which are found ordinarily in every home. For grading, sorting, and washing, shallow trays, pans, or bowls, and vegetable brushes are needed. In washing berries a colander or sieve should be used. For blanching, squares of cheese-cloth or a wire basket, together with a large vessel for holding the boiling water, should be provided. This vessel should be deep enough to submerge a convenient quantity of the products to be blanched. Slender-pointed knives are convenient for peeling, paring, and cutting. It is much better to use a silver knife for peeling fruits, as the fruit sometimes is discolored by steel. When canning in large quantities, slicers, corers, pitters, and food choppers will make it possible for one to work more rapidly. A half-pint measuring cup, teaspoon, tablespoon, spatula, scales, salt per cent scale, and saccharometer will aid in securing accurate results. If the product to be packed is to be cooked, wooden spoons, sieves, and saucepans are necessary. Packing paddles and sirup paddles will aid in filling the jars. If the canning is to be done out of doors, tables of convenient height, a covered garbage pail, and a flytrap are needed. The most convenient portable canners contain both processing and blanching compartments. A kerosene stove which burns a gas flame gives intense heat and is convenient for use in jelly making, preserving, and concentrating ketchups and sauces.

Containers

For home use, glass jars are more economical than tin, because they can be used many times and with care will last for years. New rubbers must be used each year, and it pays to get the best quality of red rubbers.

The best type of jar for home use is one with the so-called lightning seal, having a glass lid held in place by a wire clamp. This lid is not only more sanitary, but with care can be used as long as the jar lasts. For intermittent processing the lightning-seal jars are suitable, because the lifting of the wire clamp each day during processing insures that the jar will not be broken by expansion and the rubber not worn by the unscrewing of the cap.

Another type is the hermetic seal, with a lacquered metal top. The top has around the inner edge a narrow gasket of composition which, when heated, softens and adheres to the glass. The top is held in place during the processing by a wire clamp. It is self-sealing as it cools and is not suitable for intermittent processing.

If the old-fashioned screw-top jar is used good caps are essential for safety. After having been used the edge of this cap becomes flared and the porcelain lining frequently is loosened from the top. This lid then not only is difficult to sterilize but may fail to give an air-tight seal. If such jars are on hand and must be used it will be better to use them for the canning of fruits, preserves, and other products easily sterilized and to secure jars of the lightning-seal type for vegetables which are more difficult to sterilize.

Arrangement of Equipment

Discomfort and fatigue can be lessened greatly by careful planning of the arrangement of equipment used in canning. When working indoors it is often possible to carry on much of the preparation of fruits and vegetables on the porch, thus minimizing the work of clearing away refuse afterward. Canning is a much more attractive work when it is done in a cool, shady, outdoor place free from dust. This is especially true when several members of the family or a group of club members are working together. It is well to have two tables so the different stages of the work may be kept distinct. On the first table, for instance, may be placed vessels for sorting and grading, a supply of fresh cold water for washing the fruit, and a blanching basket or squares of cheese-cloth. On the second table place paring knives, spoons, measuring cups, scales, wooden paddles, sirup, brine, or seasoning, fresh clean cloths, and bowls or pans. Use this table for peeling and packing and place the garbage can near it. When jars have been sterilized they may be brought in trays to this table, inverted on a clean surface, and covered until needed. The canner should be placed so as to be convenient to both tables and should be provided with stovepipe high enough to convey the smoke above the heads of the workers.

Management of Steam-pressure Canner. In the bottom of the steam-pressure canner (retort) pour boiling water to a depth of from 1 to 1½ inches. Place canner over the fire so that the water can boil vigorously. Put cans in the crate, and lower this into retort. Put on the cover and screw down clamps so cover is on steam tight. Turn pet cock so steam can not escape

and adjust safety valve to the number of pounds steam pressure desired. Raise temperature by quick fire until the gauge on cover of retort shows the desired steam pressure. Then open safety valve or pet cock a little in order to let dead steam escape. Partly close again so only a very small amount of steam can escape, but do not close entirely. Count time from the moment steam pressure in canner reaches the pressure desired. Keep a steady fire going in order to maintain a uniform temperature until time is up. Then open pet cock or safety valve to let all steam escape before unfastening the clamps or screws holding lid down. When the gauge shows that all steam has escaped, unfasten the clamps, take off the cover, and lift the crate out. When processing in glass it is important to cool the retort somewhat before removing the containers in order to prevent loss of liquid from them. As soon as the jars are taken from the canner the lids should be tightened and a cloth spread over the jars, to protect from drafts of air, until cold. If cans are used, test for leaks by immersing in cold water. If any are found, cans must be resoldered and again processed in canner.

Canning in Glass

Select jars which are appropriate for the fruit or vegetable to be packed, considering the size of the container from the standpoint of the quantity desired when opened, the size of the fruit or pieces of fruit to be packed, and the ease of sterilization.

Sterilizing Jars. Wash these jars and place them, side down, in a vessel and cover with cold water. Bring this water slowly to the boiling point and allow to boil for 15 minutes to sterilize the jars.

Sorting and Grading. While the jars are being sterilized, sort and grade the fruit or vegetables according to size and degree of maturity. Discard all fruit that is overripe, underripe, or unsound. Vegetables which are in choice condition for the table—that is, young, tender, and fresh—are suitable also for canning. Those which have become stale are more difficult to sterilize and the loss of flavor and deterioration in texture resulting from staleness make them unsuitable for canning.

Following the sorting and grading, thorough washing is necessary before proceeding to paring, coring, or slicing. Some fruits and vegetables require scalding in order to remove peeling.

Blanching. Blanching consists of plunging the vegetable or fruit into boiling water for a short time. Use a wire basket or cheese-cloth square for this. The blanch gives a more thorough cleansing, improves the texture, and insures a clearer liquor. It also shrinks the fruit or vegetable and makes it more flexible. A full pack is then made more easily. The time required for blanching varies with the state of maturity. (See time-table, pp. 225, 226.) After blanching the fruit or vetegable is placed for an instant into cold water to make more crisp and to aid further in shrinking.

Packing. After selecting fruit or vegetable for uniformity in size and quality it should be arranged with reference to symmetry and the best use of the space within the jar. In placing the fruit or vegetable in a jar a thin, slender, flexible paddle, made out of cane or other suitable wood, is useful.

When the jar has been packed as full as possible without crushing the pieces the sirup, brine, or season-

ing is added. The paddle is also used to take out bubbles of air after the liquor has been added to the pack.

Adjusting the Rubber and Cap. Immediately before using, cleanse the rubber by dropping, for a minute, into a soda bath (1 tsp. soda to 1 qt. boiling water). Flatten the rubber in its groove, without the presence of any seed or particle of the fruit, before placing the cap. When a screw-top jar is used, screw the cap evenly about halfway. When a glass-top jar with wire clamp is used, place the lid on evenly and raise both clamps up, the upper one fastened to hold the lid in place. With a hermetic jar, fasten the cap on the jar evenly with the clamp. This type of jar is self-sealing as it cools.

Processing. Place the jars in a water bath on a rack (a wooden rack is good) to avoid breaking. Have the water the same temperature as the contents, letting it come to within 2 inches of the tops of the jars. Have a tight cover for the vessel to keep the steam around the tops of the jars which are above water. Do not count time until the water begins to boil; keep it boiling steadily for the time required. Seal the jars air-tight promptly at end of processing and remove them from the bath, being careful not to allow a cold draft to strike them. In intermittent processing, raise the clamps of the jars at the beginning of each processing to allow for expansion. Seal at close of each processing. The hermetic jar can not be used for intermittent processing.

Storing. Before storing allow jars to stand for 12 hours or more. Then examine the seal. With a lightning seal or hermetic closure, take off the clamp and test the lid to see if it is tight. With a screw-top

jar, simply invert the jar to see if there is any leak. Store all products in a cool, dry, dark place.

Sirups. In canning fruits the use of the sirups indicated in the table will give excellent results. These sirups have been selected with reference to securing good color, texture, and flavor in the finished product. For instance, sour fruits, such as cherries and plums, require a heavier sirup than sweet cherries, peaches, or berries. These sirups range in density from 10° to 50° as measured by a Balling saccharometer. The table is prepared to enable one to secure uniform results without the use of a saccharometer. No. 1 sirup is of 10° density, No. 2 of 20° density, and so on.

To make these sirups boil sugar and water together in the proportion given below until sugar is dissolved. Strain all impurities out of the sirup before using:

Sirup No. 1, use 14 ounces sugar to 1 gallon water.
Sirup No. 2, use 1 pound 14 ounces sugar to 1 gallon water.
Sirup No. 3, use 3 pounds 9 ounces sugar to 1 gallon water.
Sirup No. 4, use 5 pounds 8 ounces sugar to 1 gallon water.
Sirup No. 5, use 6 pounds 13 ounces sugar to 1 gallon water.

Measurements. If no scales are available, the amounts of sugar may be approximated by measuring, using 1 pint for each pound and 16 tablespoons to the half pint. For the recipes given in this bulletin all measurements are level and the standard measuring cup holding ½ pint is used. Abbreviations used are c., cup; tbsp., tablespoon; tsp., teaspoon; oz., ounce; and lb., pound.

Fruits

The temperature obtained in a hot-water bath canner is the best to use in canning fruits. The time for

processing, given in each recipe which follows, is intended for this water-bath outfit with temperature at boiling, and should not be counted until boiling begins.

Apples. Apples shrink more in canning than most fruits and for this reason should be blanched for 1 minute. Plunge them into a cold bath, then pack. Cover with No. 1 sirup, and process quart jars 12 minutes.

This method of canning apples is not economical because the apple is juicy and needs no water added. A better method perhaps is to make a sauce out of the apples. This may be done by steaming them until tender and passing them through a sieve. Allow 1 c. sugar to each gallon of pulp. Reheat until the sugar is dissolved, pack hot in sterilized jars, and process quart jars 12 minutes.

Berries. For dewberries, blackberries, loganberries, huckleberries, raspberries, and currants practically the same methods of canning may be used. The condition of the fruit will have much to do with the quality of the product. Berries should be gathered in shallow trays or baskets and not in deep vessels which allow them to be bruised and crushed. They should be uniformly ripe, sound, and as large as possible.

The flavor of canned berries will be finer if sugar is used in canning. It is best to make this into a sirup. The use of berry juice instead of water in this sirup will give a richer color and flavor. For fine berries, use a No. 3 sirup, substituting berry juice for water.

After the berries have been sorted carefully and washed lightly by placing in a colander and pouring water over them, instead of immersing them in water,

pack as closely as possible without crushing. This can be done better by putting a few berries into the jar, pressing them gently into place, and proceeding layer by layer, than by nearly filling the jar loosely and then trying to press them down.

Fill jars full of fruit and cover with sirup. Process pints 10 minutes and quarts 12 minutes.

Cherries. When canned whole, cherries should be blanched for 15 seconds to prevent splitting. For sour cherries use No. 4 sirup; and for sweet ones No. 3. Process quarts 25 minutes.

Figs. Figs for canning should be sound and firm. Sprinkle 1 c. of soda over 6 quarts of figs and add 1 gallon of boiling water. Allow the figs to stand in the soda bath for 5 minutes. Drain and rinse thoroughly. Bring 2 quarts of the No. 3 sirup to boiling and add the well-drained figs. Allow the fruit to boil in this sirup for 1 hour. Place the fruit carefully in the jars and then fill to overflowing with the sirup. Process quart jars for 30 minutes.

Gooseberries. Since green gooseberries contain sufficient acid to preserve them without sterilizing, they may be packed, like rhubarb, in cold water or as a sauce.

Make the sauce by cooking together the sugar and fruit in the proportion of ½ c. of sugar for each quart of gooseberry pulp. When the sugar is dissolved, pack the sauce hot and process for 10 minutes. Ripe gooseberries are packed in a No. 3 sirup and processed as other berries.

Guava. Only firm, sound guavas should be used for canning. Pare the fruit, cut into halves, and remove the seeds. Float the halves in boiling water for 20 seconds. Drain and pack carefully as for peaches.

Fill the jars to overflowing with No. 4 sirup and process quarts for 25 minutes.

Peaches. Before preparing fruit make sirup No. 3 or 4 (see sirup table), allowing about 1 c. of water for each quart jar. Put in one cracked peach pit for every quart of sirup. Boil for 5 minutes and strain.

Sort the fruit, using firm, sound, uniform peaches for canning and putting aside the soft broken ones for jam. Peeling may be done by immersing in boiling water about 1 minute or until skins slip easily. Remove, plunge for a minute into cold water, and slip off the skins. Cut into halves and pack at once, placing the halves in overlapping layers, the concave surface of each half being downward and the blossom end facing the glass. Fill each jar with sirup and paddle carefully to remove air bubbles. Process quarts 20 minutes and half gallons 35 minutes.

Firm, perfect peaches may be floated in boiling water for about 20 seconds after being peeled. They are then cut in halves, seeds removed, and packed as indicated above. By floating the peaches in this manner, they are made more flexible and pack to better advantage; they also become mellow, absorb more sirup, and are finer in flavor.

Pears. Select ripe pears which are not too soft. Peel, blanch by lowering for 15 seconds in boiling water, put in cold bath, drain, and pack rapidly This blanch will make the hard varieties of pears pack better and give them a more transparent appearance. When packed whole, leave stems on and place each layer stems up, letting the second row fill the spaces between the two stems, and repeat.

When the jars have been packed with fruit, fill with No. 3 sirup and process quarts for 25 minutes.

Plums. Select sound, uniform fruit. Prick with needle to prevent bursting. Pack as firmly into the jars as possible without crushing and fill with a No. 4 sirup. Process quarts for 15 minutes.

Rhubarb. Because of its extreme acidity, rhubarb can be canned safely without processing. Select young, tender rhubarb and cut either into 2-inch pieces or into lengths to fit the jar when placed vertically. Pack in sterilized jars in vertical rows. Cover with fresh cold water and allow jars to stand 10 minutes. Drain off the water and again fill to overflowing with fresh cold water. Use sterilized rubber, cap and seal at once. In the far South rhubarb should be processed in a hot-water bath, pints 10 minutes, quarts 20 minutes, at boiling.

Since rhubarb contains much water, a better and more economical product could be secured by canning rhubarb sauce. Cut the rhubarb into 1-inch lengths and steam until tender. For each quart of sauce add ½ c. of sugar. Pack hot in sterilized jars and process quarts for 10 minutes.

Fruit Juices. The juices of such fruits as grapes, currants, blackberries, strawberries, raspberries, elderberries, and cherries make a delicious and wholesome drink, and should be much more widely used in the home. The flavor of these juices is finer when they are sterilized below the boiling point. Select sound ripe fruit, crush, and heat slowly to about 180° F., simmering point. Strain through double thickness of cheese cloth, and if juices free from sediment are wanted, let stand in a cool place for a few hours. Then pour off carefully to free from the dregs, which will remain in bottom of vessel. The addition of sugar will make flavor finer. It may be used in any desired proportion,

a fair allowance being 1 c. of sugar to 1 gallon of juice. It is more economical to sweeten some fruit juice with the natural sirup obtained from the same fruit—for example, apple and grape. Pour the juice into sterilized bottles, put sterilized stoppers in lightly, set bottles on rack in water bath, and process at simmering point for 30 minutes. Remove from water bath, put stoppers in tightly, and when cool dip top of bottle into melted paraffin or sealing wax. A good wax may be made by melting together equal parts of rosin and beeswax.

These homemade fruit juices will be excellent for use in gelatin desserts, puddings, sauces, ice cream, sherbet, etc. They can be bottled without any sugar and later made into jelly. This method for grape jelly insures the getting rid of crystals, which are objectionable in jelly.

Vegetables

Either the water bath or the steam-pressure canner may be used in processing vegetables. For certain vegetables that are difficult to sterilize, there is an advantage in the saving of time, labor, and fuel by the use of a steam-pressure canner. The temperatures in the following recipes are given in Fahrenheit readings, because this thermometer ordinarily is furnished with steam-pressure outfits. The time given for processing under steam is for one continuous period. In canning vegetables that have become somewhat stale, the period of processing should be lengthened. (See time-table.)

Brining and Seasoning. Brine or water is added, immediately after packing, to such vegetables as need

to be surrounded by liquid either for proper preparation or for sterilization. No more liquid is allowed than is actually necessary to cover the contents after as full a pack as possible is made. For seasoning tomatoes, peas, lima beans, and corn, a mixture of sugar and salt is added. This seasoning improves the flavor of these vegetables greatly. Mix the sugar and salt in the proportion of one-third salt and two-thirds sugar. Add the seasoning at the rate of 1 level tsp. for each pint of vegetables. Brine for beans, okra, etc., should contain $2\frac{1}{2}$ oz. salt to 1 gallon of water. For asparagus a heavier brine is needed.

Asparagus. It is of the greatest importance that asparagus for canning be fresh and tender. Select tips of uniform size and maturity and wash them. Cut in right length for cans, scrape off tough outer skin, and tie in bundles. Blanch by immersing the lower ends part way in boiling water for 2 minutes. Then immerse the entire tips for 1 to 2 minutes longer. Plunge into cold water, then pack neatly, tips up. Fill jars with brine ($4\frac{1}{2}$ oz. salt to 1 gallon water) and process pints in a hot-water bath 1 hour on each of three successive days or in a steam-pressure canner 30 minutes under 10 lbs. steam, at a temperature of 240° F. In the far South it may be necessary to raise the temperature to 250° F. for the same period.

String Beans. The Refugee is a good variety for canning. The beans should be tender and fresh. When the beans within the pod have grown to any size, canning is more difficult and the product of poorer quality from a commercial standpoint. For canning, only well-sorted, small, tender beans should be used. String the beans and cut them into 2-inch lengths; cutting diagonally or " on the bias " gives a pretty

product. In glass they may be canned whole, packed log-cabin fashion in square jars. Blanch 3 to 8 minutes or until the pod will bend without breaking, and plunge into cold water for an instant. Drain well, pack quickly, and cover with brine. When the beans are young and tender, process quarts 2 hours continuously at boiling temperature, or, if more mature beans are packed, process intermittently, or 45 minutes under 10 lbs. steam, at a temperature of 240° F.

Lima beans are treated as string beans, except that sugar and salt seasoning are added instead of brine. This seasoning is added when the jar is half packed with beans. When the jar is filled with beans, cover them with clear water, paddle to remove air bubbles, and process as for peas.

Baby Beets. The best variety of beet for canning is the Detroit. From the standpoint of quality, only young, tender beets should be canned. Sort, putting uniform size together. In preparing beets for boiling, be careful not to cut the stems off too closely or to break the root. This will cause loss of juice with accompanying loss of color and flavor. Boil until three-fourths done, peel, pack in layers of three or four, fitting the second layer into the spaces left by the first layer, and repeat. Cover with clear hot water. Process quart jars 1 hour at 212° F. or 30 minutes under 5 lbs. steam. Do not allow cold water to touch the beets after they have been cooked.

Carrots. Proceed the same as for beets.

Corn. Much depends upon careful selection of tender, juicy corn before it reaches a starchy stage. It should never stand longer than a few minutes after being taken from the stalk. Corn which has passed the milky stage or is stale is very difficult to sterilize.

Blanch on the cob 1 to 3 minutes. Cut; pack into jars to within 1-inch of the top. Add salt and sugar seasoning and cover with clear water. Paddle to allow liquor to penetrate to the bottom of the jar. Process quarts at 212° F. intermittently for 1½ hours on the first day and 1 hour on the two succeeding days, raising the clamp during each processing. Corn expands in cooking and jars may be broken unless lids are loosened during processing. For pints, let the period of processing be 1 hour each time. With steam under pressure, process corn 1 hour and 20 minutes under 15 lbs. pressure at a temperature of 250° F. Take every precaution to have good rubbers.

Okra. Select young, tender pods, remove stem without cutting into seed pod. Blanch 6 to 8 minutes. Plunge into cold salt bath as for peas. Pack, cover with brine, and process intermittently, or 30 minutes under 10 lbs. steam pressure.

Peas. Peas are more difficult to can than most other vegetables, and great care should be taken to have them very fresh and young. They are best gathered in the early morning or when cool. Work should be done rapidly, and peas should not stand after being shelled. Shell and sort, putting peas of the same size and degree of maturity together. Be sure not to use hard ripe peas among tender ones.

Blanching is very important. If well done it prevents cloudy liquor, makes the peas tender, and also removes some of the gluey substance which coats them. Blanch 1 to 4 minutes, depending upon the maturity of the peas. Put again into cold salt water (1 tbsp. salt to 1 qt. water) for an instant after blanching.

Drain and pack to within ½ inch of the top of the jar. If too full, some of the peas will burst and make

the liquor cloudy. Add sugar and salt seasoning, fill with water, and paddle well.

If peas are very small and tender, process pints at boiling for 2 hours continuously. If medium-sized peas are packed, process intermittently at boiling or 45 minutes under 10 lbs. steam pressure.

Peppers. The best sweet peppers for canning are the Spanish varieties known as pimentoes. The fruit of these peppers has very thick flesh, tough skin, and is comparatively smooth and free from ridges. The bell peppers are not suitable varieties for canning. Peppers should be ripe, sound, and free from bruises. Sort, using the whole peppers for canning and small or broken peppers for products such as sauces, soups, chutneys, and Dixie relish. Prepare for peeling by placing peppers in a hot oven for 6 to 8 minutes, being careful not to allow them to become hot enough to discolor. Peel, cut out stem, remove seeds, and pack dry in flattened layers. No water or seasoning is used in the preparation of these peppers; the processing brings out a thick liquor which almost covers them in the can. Process pints for 30 minutes.

Sweet Potatoes. The canning of sweet potatoes with uniformly successful results is difficult. It is very much better to use correct methods of storing than to can them.

A sweet potato which is dry and mealy when canned is desirable. The Nancy Hall is one of the best varieties for canning. Triumph and Southern Queen also are used.

Processing sweet potatoes intermittently tends to darken the product; therefore a continuous period of processing at boiling is advised for home use. Select absolutely sound potatoes and grade, putting together

those of the same size. Boil or steam until three-fourths done. Peel and pack hot at once to prevent discoloring. Process 3 to 5 hours continuously at boiling, or 70 minutes at 250° F.

Concentrated Vegetable Soup. Any desired mixture of vegetables may be packed for home use. A good combination consists of 1 quart concentrated tomato pulp, 1 pint corn or tiny lima beans, 1 pint okra, 4 tsp. salt and sugar seasoning, 1 small onion chopped, and ½ c. of chopped sweet red pepper. Cook the tomatoes, pepper, and onion, put through a sieve to remove seeds, and cook down to about the consistency of ketchup. Measure, add the corn or beans and okra, which have been prepared as for canning, add seasoning, and cook all together for 10 minutes. Pack and process quarts for 2 hours continuously at boiling, or for 30 minutes under 10 lbs. steam pressure. (See recipe for tomato paste.)

Spinach. Prepare the spinach by cutting off all dead leaves and roots. Cover each peck of spinach thus prepared with scalding soda solution (1 tsp. soda to 1 gallon water) and allow to stand for 2 minutes. Wash thoroughly through several cold waters, and drain well. Blanch in rapidly boiling water for 4 minutes. Drain well, pack into jars, cover with boiling brine, and process pint jars 1 to 2 hours at boiling, or 30 minutes under 5 lbs. steam pressure.

If it is desirable to can other greens, these directions may be followed.

Tomato. Select firm, uniformly red, ripe tomatoes of medium size. Put into trays and lower into boiling water for 1 minute. Remove and cut out the core with a slender-pointed knife without cutting into the seed cells. Peel promptly and pack into jars. Add

sugar and salt seasoning and fill the jars with a thick tomato sauce. This procedure is economical, because each quart jar will give whole tomatoes for salads or baking and a tomato purée for soups or sauces. This purée or sauce, which is poured over the whole tomatoes, is made by cooking the small or broken tomatoes until tender. The seeds are then removed and the pulp is concentrated by boiling to about the consistency of ketchup. Process quarts 25 minutes at boiling.

Tomato Sauce or Purée. If a more economical utilization of space within the jar is desired, a more concentrated mixture can be packed. This also provides for the use of small or broken tomatoes and large tomatoes unsuited for canning.

Cut the tomatoes and add 1 large-sized onion chopped and 1 c. chopped sweet red pepper to each gallon of tomatoes. Cook until tender, put through a sieve, and add sugar and salt seasoning in the proportion of 1 tsp. to each quart of pulp. Cook until the consistency of ketchup, stirring constantly. Pack hot into jars or bottles and process pint jars 25 minutes at boiling.

Vegetable Mixtures. Attractive and economical vegetable mixtures to be served in salads, with omelets or escalloped dishes, and as garnishes for meat dishes can be packed. This can be done often when small quantities are left from packing different vegetables whole. Any desired combinations may be made. Vegetables maturing in the same season should be used. A good combination for the spring would be carrots, peas, string beans, and onions. A mixture which could be made from the fall garden might consist of peppers, celery, onions, and small lima beans. All these vegetables are prepared separately, as for canning,

and packed in layers in the jar. Each layer should be packed as tightly as possible before the next is added. When the jar is filled, cover with brine and process 2 hours continuously or intermittently. Beets can not be used in this mixture because they discolor the entire contents of the jar.

The time-tables given for processing are safe only when young vegetables are secured. Mature or tough vegetables require a longer period or higher temperature.

Canning in Tin

Before undertaking canning in tin, special equipment, including capping steel, tipping copper, fire pot for heating tools, cans with solder-hemmed caps, flux, sal ammoniac, and wire solder, must be secured. Follow all instructions for canning in glass up to the point where packing is done. See time-table for blanching period and for processing period for containers of different sizes. Note also the vegetables and fruits which require enamel-lined or inside-lacquered cans.

NUMBER OF CANS PER BUSHEL YIELDED BY THE FOLLOWING VEGETABLES

1 bushel of tomatoes yields 24 No. 2 cans.
1 bushel of tomatoes yields 18 No. 3 cans.
1 bushel of beans yields 20 No. 2 cans.
1 bushel of beans yields 14 No. 3 cans.
1 bushel of peas in hull yields 25 No. 2 cans.
100 ears of corn yields 30 No. 2 cans.

Flux is used in cleaning and retinning tools and is also used in sealing the cans. It is brushed around the cap before the hot tool is applied, and causes the solder to adhere to the tin.

Making Flux. Put some commercial hydrochloric (muriatic) acid into a glass or crockery vessel (not metal), add strips of sheet zinc until no more can be dissolved. To this add an equal quantity of water. Label this " Flux " and use carefully. When canning, have one vessel (a can will do) with enough flux in it to clean the tools. Keep separately in a glass bottle the quantity to be used in sealing cans.

Cleaning and Tinning the Steel and Copper. It is of first importance to have the capping steel and tipping copper in good condition. These may need to be rubbed with coarse sandpaper or on a soft brick to smooth them, or the steel may have to be filed to remove the rust. In the latter case care must be taken to keep the edge of the steel true. Both the capping steel and tipping copper must be kept tinned or coated with solder to make the solder flow evenly when sealing. Have ready in a can a handful of sal ammoniac mixed with a few pieces of solder. Heat the already smoothed capping steel or tipping copper until almost red hot, dip into the flux, then into the sal ammoniac and solder, turning it about and rubbing until bright and well coated with solder. Then dip into the flux again.

Packing. (See table, p. 225, for size of cans to use for different vegetables.) The Federal laws require cans packed for sale to be filled as full of food as is practicable for processing and to contain only enough liquor to fill the spaces and cover the contents. Weigh a sufficient number of cans before and after filling to obtain an accurate idea of average net weight. On account of expansion in processing, corn can be packed less full than other vegetables. These instructions do not cover the canning of corn for market. Mark the

cans with a pencil or knife to show contents. Plan in advance and work rapidly. Let one person do the packing and another attend to the weighing. Do not allow filled cans to stand before adding liquor and exhausting. To do so will injure the product.

Adding Brine, Sirup, or Water. After adding to within ¼ inch of top, shake the can gently to displace all air within it. Now clean and wipe the groove around the opening. Slip on the cap, and weigh before sealing to be sure of having the required weight.

Fluxing and Capping. Apply the flux carefully around the groove, making sure that none of it enters the can. Use a small brush or cord, or little mop made by tying a piece of clean white cloth around the end of a small stick. The flux is used to make the solder adhere to the tin. Apply the clean, hot capping steel, holding the cap in place with the center rod while you lower the steel, and turn it steadily until the solder flows. Hold the rod firmly and lift the steel with a sudden twist, to swing the melted solder around the groove evenly.

A good fire pot can be made out of a galvanized bucket if ingenuity be employed. Charcoal or corn cobs can be used as fuel.

Exhausting. Place the cans in trays, and lower into boiling water to within 1 inch of the top to, drive the air out of the cans. Let them stay the shortest possible time necessary to drive out the air. Ordinarily 3 minutes is enough, and the temperature need not again reach boiling before cans are taken out. Exhausting is necessary. If omitted, the air left in the can expands, causing it to bulge. The can may not resume normal shape again, or if it does and is exposed to a warmer temperature it may again expand, giving the

appearance of a "swell." This will not only prevent sale of that can, but may also cut off future orders. Furthermore, the presence of air may cause the tin to dissolve more readily and enter into the food.

Tipping. Close the small hole in top of the can immediately after exhausting. Apply flux as for capping, and use a little wire solder to close the hole. Hold the solder with the left hand near the hole, and barely touch the hot copper to it, so that only a bead will drop and cover the hole. This makes a neat tip.

Processing. Boil the cans which have been exhausted and tipped, to sterilize the contents. Have the water boiling vigorously when the cans go in. Lower cans slowly under the water and look out for any showers of bubbles from the can. These show that it leaks at the point from which the bubbles come and must be taken out and resoldered. Begin counting time when the water first boils after immersing the cans. Keep it boiling constantly. In intermittent processing, the vegetable is processed for 1 hour on each of 3 successive days. The time sometimes is reduced to 2 days with very young string beans and some more easily sterilized vegetables. It is not possible to state the shortest time which may be used safely, because of the varying conditions.

Cooling. Cool all canned products as quickly as possible to stop the cooking, which breaks down the fruit and injures the flavor and color. Plunge the cans into very cold water immediately, especially when processing intermittently. Never stack cans close together until entirely cold.

Labeling. After 8 to 10 days, or immediately before selling, label all cans. Place the sealed end down, so that the opposite end will appear at the top when

placed on the shelf. Use a rather dry paste, and put it only on the end of the label, so that no paste will touch the tin. If paste touches the can, it may cause rust. Where a damp climate causes cans to rust easily, the outside of the can may be lacquered before being labeled. Net weight in pounds and ounces, and packer's name and address, should appear on each label.

Standards for 4-H Brand Canned Vegetables

Tomatoes. Cans to contain not less than 2 pounds 1 ounce tomatoes in No. 3 and not less than 1 pound 4 ounces tomatoes in No. 2 cans. To be filled with sound ripe fruit, carefully peeled and cored; tomatoes to be whole or in large pieces, firm, uniformly red, and of good flavor. No juice in excess of the amount present in the tomatoes canned is allowed. Any water is considered an adulteration.

Tomatoes and Green Pepper. Cans to contain not less than 2 pounds packed in No. 3 cans. For this pack add 1 medium-size green sweet pepper, after removing the stem and seeds, to each can of tomatoes.

String Beans. Net weight, in No. 3 can, before liquor is added, should be at least 1 pound 8 ounces, brine 8 to 10 ounces. Net weight in No. 2 can should be 13 ounces beans and about 8 ounces liquor. Beans to be tender, green, uniform in size, well strung, and of good flavor. The net weight appearing on label for No. 3 can should be 2 pounds, and for No. 2 can 1 pound 5 ounces.

Peas. No. 2 cans to have at least 13½ ounces net weight of peas and about 8½ ounces liquor; peas to be fairly uniform in size, tender, whole, and of good flavor; liquor clear. Net weight appearing on label should be, for No. 2 cans, 1 pound 8 ounces.

Baby Beets. To be packed in No. 2 lacquered tins, about 30 baby beets to each can, maximum size $1\frac{1}{2}$ inches in diameter and average size 1 inch in diameter. No. 2 can to have at least 16 ounces whole beets and 4 ounces liquid. Net weight appearing on label should be, for No. 2 cans, 1 pound 4 ounces.

Okra. Net weight of contents in No. 3 can should appear on label, 2 pounds. Only young, tender okra should be packed, and it is best simply to remove the cap without cutting into the seed pod and to pack it whole. Brine is added as explained in the table.

Peppers. No. 2 cans to contain from 8 to 10 whole peppers. Flat No. 1 cans to contain 4 or 5 whole peppers. Net weight of contents appearing on the label should be for No. 2 can not less than 1 pound, or flat No. 1 can not less than 8 ounces.

Soup Mixture. This should consist of a mixture which is made in the proportion of one-half tomato pulp, one-fourth corn or tiny lima beans, and one-fourth okra, with seasoning added. One slice of onion 2 inches in diameter should be added to each No. 2 can. The tomatoes should be heated, rubbed through a sieve and cooked down to about the consistency of ketchup before measuring; then the corn, okra, onion, and seasoning should be added and cooked until the corn and okra are about three-fourths done. Then pack into cans and follow directions as given in the table below. Net weight appearing on label of No. 2 can should be 1 pound $4\frac{1}{2}$ ounces.

Standards for 4-H Brand Canned Fruits

Figs. The net-weight contents of a No. 2 enamel-lined can of figs should, as shown on the label, be not less than 1 pound 6 ounces. Figs should remain

TIME-TABLE FOR CANNING VEGETABLES

[Do not attempt to use this table without reading all directions carefully.]

Hot-water Process

Vegetable.	Blanch, Minutes.	Liquor.	No. of Can.	Exhaust, Min.	Process.
Asparagus	3 to 4	Brine (heavy)	2	3	Intermittent or 2 hours.
String beans	3 to 8	Brine	2	3	Do.
Do		do	3	5	Intermittent.
Lima beans	2 to 5	Salt, sugar, water	2	3	Do.
Beets	Cook $\frac{3}{4}$ done, peel	Brine	2	3	1 to 2 hours.
Carrots	Cook $\frac{3}{4}$ done, scrape	do	2	3	1 hour.
Corn	1 to 3 (blanch on cob)	Salt, sugar, water	2	10	Intermittent.[1]
Okra	6 to 8	Brine	2	3	Do.
Peas	3 to 5	Salt, sugar, water	2	3	Do.
Peppers	Roast	Omit	1	3	25 minutes.
Do	do	do	2	3	30 minutes.
Potatoes, sweet	Steam $\frac{3}{4}$ done, peel	Pack dry	3	15	3 to 5 hours.
Rhubarb		Cold water	2	2	15 minutes.
Soup, concentrated vegetable		Salt, sugar	2	5	2 hours or intermittent.
Spinach	4	Brine	2	3	1 to 2 hours.
Tomatoes		Salt, sugar	2	2	20 minutes.
Do		do	3	3	25 to 30 minutes.
Vegetable mixture		Brine			Intermittent or 2 hours.

[1] See recipe.

Steam Pressure

Vegetable.	Process.	Temp.	Pressure.	Vegetable.	Process.	Temp.	Pressure.
	Minutes.	° *F.*	*Pounds.*		*Minutes.*	° *F.*	*Pounds.*
Asparagus	30	240	10	Okra	30	240	10
String beans No. 2	45	240	10	Peas	45	240	10
String beans No. 3	55	240	10	Soup, concentrated vegetable	30	228	10
Beets	30	228	5	Spinach	30	228	15
Corn	80	250	15	Sweet potato	70	250	15

Note.—String beans packed in No. 2 cans are preferable because more surely sterilized.
Corn, lima beans, and peas should never be packed in larger container than No. 2. Corn is cut from cob after blanching.
The brine used is made of $2\frac{1}{2}$ ounces salt to 1 gallon of water, except for asparagus, which contains 4 ounces to 1 gallon.
Beets and rhubarb when packed in tin must be put in enamel-lined cans.
Process pints as for No. 2 cans; quarts as for No. 3 cans, adding 10 minutes to each period.
String beans when more mature should be processed at 15 pounds pressure for 30 minutes for No. 2, and 45 minutes for No. 3.

TIME-TABLE FOR CANNING FRUITS

Fruit.	Blanch.	Sirup.	In Tin.			In Glass.	
			No. of Can.	Exhaust, Minutes.	Process, Minutes.	Jar.	Process, Minutes.
Apples	1 minute	No. 1	3	2	8	Quart	12
Berries		No. 3	2	2	10	Quart	12
Cherries, sweet.	15 seconds	No. 3	2	2	20	Quart	25
Cherries, sour.	15 seconds	No. 4	2	2	20	Quart	25
Currants		No. 3	2	2	15	Quart	15
Figs	Soda blanch	No. 3	2	2	25	Quart	30
Gooseberries		No. 3	2	2	15	Quart	20
Guava	15 seconds	No. 4	2	3	20	Quart	25
Guava	15 seconds	......	3	3	25	Pint	25
May haw		No. 3	2	2	20	Quart	25
Peaches	15 seconds	No. 4	3	3	15	Quart	20
Pears	15 seconds	No. 3	3	3	20	Quart	25
Plums	Prick with needle	No. 4	2	2	12	Quart	15

NOTE.—Berries, cherries, currants, figs, gooseberries, May haws, and plums when packed in tin must be put in enamel-lined cans.

To make the sirups recommended, boil sugar and water together in the proportion given below until sugar is dissolved. Strain all impurities out of the sirup before using.

Sirup No. 1, use 14 ounces to 1 gallon water.
Sirup No. 2, use 1 pound 14 ounces to 1 gallon water.
Sirup No. 3, use 3 pounds 9 ounces to 1 gallon water.
Sirup No. 4, use 5 pounds 8 ounces to 1 gallon water.
Sirup No. 5, use 6 pounds 13 ounces to 1 gallon water.

The sirup for canned berries is made out of berry juice instead of water.

whole and a No. 2 can should contain about 30 to 35 whole figs.

Peaches. A No. 3 can should have at least 1 pound 5 ounces solids (from 10 to 12 halves of peaches) and 11 ounces liquid, and the net weight appearing on label should not be less than 2 pounds.

Pears. The net weight in a No. 3 can should be not less than 2 pounds, having 11 ounces liquid, 1 pound 5 ounces solids (from 12 to 14 halves of pears).

Berries. The net weight of a No. 3 can of blackberries or raspberries should be 2 pounds; of a No. 2 can, 1 pound 6 ounces; whole berries weighing about one-half of total in each case. The berries should be large, whole, and of good color and flavor. The sirup used in packing must be made out of strained berry juice and sugar, with no water added. Enamel-lined cans always should be used.

Jams, Fruit Butters, and Marmalades

Jams are made of small fruits which are not whole or firm enough to use for preserves. No attempt is made to retain the original shape of the fruit, the finished product having a uniform consistency. Marmalades have a more jelly-like texture, and thin slices of the fruit appear suspended throughout the mixture. In fruit butters and pastes frequently less sugar is used than in jams, and the product is more concentrated. Conserves may be made of large or small fruits, cooked in the same manner as jams. Sometimes nuts are added.

With jams, preserves, and jellies, it is advisable to use a chemical thermometer, Centigrade reading ranging from 0° to 110°, which, having fewer figures than a Fahrenheit instrument, is more easily read. The stem of this instrument should be 12 or 14 inches long, so that the reading will appear far enough above the surface to be easily seen. Fahrenheit readings given in recipes are approximate.

Well glazed, hermetically sealed stoneware jars with capacity of 8 oz. and up, are suitable and attractive containers for packing jams, marmalades, relishes, and pickles.

Jams and marmalades may be packed hot in sterilized jars and sealed immediately. When packing for market, however, it is far safer to process them both to insure sterilization and a tight seal. Process pints for 30 minutes at simmering (87° C.) or 188° F.

*Apple Butter.** Measure the apples, wash to remove dirt, slice into small pieces, and for each bushel of apples add 4 gallons of water; boil until the fruit is soft, then rub through a screen or sieve.

To the pulp from each bushel of apples add 2 gallons of cider that has been concentrated to one-half its original volume. Bring to a boil and add 12 lbs. of sugar. Continue the cooking, and just before the consistency desired for finished apple butter is reached add spices, cinnamon, and cloves, according to taste. When the butter is as thick as desired, place in sterilized containers and seal immediately.

Berry Jam. In selecting berries for jam, the ripe, broken ones will give fine color and flavor, but about one-half the quantity should be slightly underripe. This is necessary to give a jelly-like consistency to the product. Cooking in small quantities also helps to retain color and flavor. Weigh the berries and allow three-fourths of a pound of sugar to each pound of fruit. Rapid cooking with constant care is essential.

In stirring jam use a wooden spoon or paddle, moving it across the center of the vessel first one way and then the opposite and next around the pan, gently moving the mixture from the bottom of the pan, being careful not to stir rapidly or beat. Cook the jam to 105° C. or 221° F. When finished it will give the

* Recipes marked with an asterisk were furnished by the Carbohydrate Labatory of the Bureau of Chemistry.

same test as required for finished jelly; that is, when a little is held a moment and cooled in a spoon, it will not pour from the side of the spoon but will fall in a sheet or flake. Pack and seal while hot.

Fig Jam. Select very ripe figs, remove all stems, treat them with scalding soda solution, and rinse thoroughly. (See Fig. Preserves, p. 237.) Cook in quantities nor larger than 3 lbs. at one time. Allow 1½ lbs. sugar to each 3 lbs. of figs. Add barely enough water to start the cooking (about one-half cup), crush the figs, heat to boiling, and add the sugar. Cook rapidly to 105° C. or 221° F., following instructions given under Berry Jam. Pack and process at simmering for 30 minutes.

Guava Paste. Wash the guavas, remove blossom end, and cut into small pieces. Add sufficient water to start cooking without burning, cook until very soft, rub through a sieve; a flour sifter may be used successfully. Measure the part which has passed through the sieve and for each cup of guava add one-half cup of sugar. Continue the cooking (stirring constantly to prevent burning) until the excess of water is driven off, which is recognized by the manner in which the mixture leaves the pan on stirring. Remove from the fire, pour on a marble slab or on paraffin paper, and when cold cut into slices and pack in a box lined with paraffin paper.

Peach jam.

2¼ lb. peaches cut into small pieces.	½ c. peach juice.
1 lb. sugar.	½ tsp. whole cloves.
6 whole allspice.	1 tsp. cinnamon bark.
1 cracked peach seed.	1 sprig mace.
1 inch ginger root.	

(Tie spices in cheese-cloth bag.)

Cook all together until thick as marmalade and clear (to 105° C. or 221° F.). Pack hot in hot jars and seal at once, or process.

Citrus Fruit Marmalade (three-day method).* 1 grapefruit; 1 orange; 1 lemon. Wash fruit and then cut very thin through pulp and rind, discarding all the seeds. Weigh the fruit and to each pound of the fruit add 3 pounds of water. Let stand over night. Next day boil for 30 minutes and let stand for 24 hours. Next day measure or weigh the fruit, and for each pound or portion of fruit juice add 1 pound or portion of sugar. Bring to a boil and cook until it jellies, stirring so as to keep from burning. Place in glasses or jars while still hot, allow to cool, and then cover with paraffin.

*Sweet Orange or Grapefruit Marmalade.** Wash the fruit, weigh the peel and discard one-fourth of it, and note the weight of edible portion plus the remaining peel. Place peel in water, boil for 5 minutes, and pour off water. Again cover peel with boiling water and allow to simmer over the fire until tender. Pour off water and add cold water to harden the peel. Then cut into as thin slices as possible. Place edible part of the orange or grapefruit in a kettle with twice the amount of water as of fruit, and boil until the pulp has disintegrated. Strain through a muslin or cheese-cloth bag, and for each pound of the edible portion and shredded peel add 1½ lbs. sugar. Boil until the jellying point is reached.

*Sour Orange Marmalade.**

1 pound peeled sour oranges.
2 pounds water.
1 pound sugar.

Preparation of the peel: Wash fruit, remove peel; discard one-fourth of the peel, using the portion free from blemish. Cut this peel into as thin slices as possible, place in a kettle with four times its weight of water, boil for 10 minutes, and drain free from water. Repeat this process three times.

Preparation of the juice: After the peel has been removed, weigh the fruit, cut into small pieces, place in a kettle, and for each pound of orange add 2 lbs. water. Boil until it thoroughly disintegrates. Pour into a flannel jelly bag and press until no more juice can be obtained. Again drain juice through a clean flannel jelly bag without pressing.

Pour this juice into a kettle, add the peel, bring to a boil, add 1½ lbs. sugar for each pound of fruit, and continue the boiling until the jelly stage is reached, which is indicated by the flaking or sheeting from the spoon.

Grape Jam. Select grapes about one-half of which are underripe rather than entirely ripe. Wash and stem the fruit. Separate the pulp from the skins. Cook pulps for 10 minutes and press through a sieve or colander to remove seeds. Add three-fourths cup of water to each quart of skin and boil until tender. Then put the pulp and skins together and measure. For every quart of the mixture use 1 lb. of sugar. Bring the fruit to a boil, add the sugar, and cook, stirring frequently until it will give the jelly test or reaches 105° C. or 221° F. Pour into sterilized jars and process as for jam.

Gingered Pears. Use pears not quite ripe, peel, core, and cut into thin slices. To 8 lbs. of pears, allow 6 lbs. sugar, 1 cup of water, and the juice of 4 lemons. Cut the lemon rinds into thin strips, and add them. Also add one-eighth pound of ginger root cut into

pieces. Simmer until thick as marmalade. Pack like peach jam.

Damson Plum Conserve.

4 pounds plums.
3 pounds sugar.
1 pound shelled nuts.
2 oranges.
1 pound raisins.

Remove the seeds and chop the plums. Peel the oranges and slice thinly one-half of the peel. Discard the other peel and the seeds. Mix chopped plums, orange pulp, sliced peel, sugar and raisins. Cook all together rapidly until bright and thick as jam. Add nuts 5 minutes before removing from the fire. If a thermometer is available, cook to 102° C. or 215° F. Add the nuts and cook to 103° C. or 217° F. Remove from fire, cool, and pack into jars.

Figs, after treating with soda as for preserves, may be made into conserve by this method.

Fruit pastes, as they are called, consist of boiled-down fruit pulp with sugar added according to the acidity of the fruit, and are improved in flavor if several varieties of fruit are mixed. After the fruit paste is made (see recipes), it can be colored red, yellow, or green with harmless vegetable colors. The coloring is stirred into the boiling mass after removing from the fire. Different flavors also can be added at this stage if desired. The paste is poured out in a half-inch layer on flat dishes, marble, or glass slabs, which are first rubbed with a cloth dipped in a good salad oil. The dishes are then exposed to draft for a couple of days, after which the paste is cut into figures. If the paste is well boiled down it is dried more easily. (Many small forms useful for cutting the paste can be had on the market.) The paste can also be cut with a common

knife or with a fluted vegetable knife, or it can be cut in round cakes, the center of which is again cut with a smaller circular cutter; there will thus be both rings and small round cakes. The cut paste is placed on paper, sprinkled with crystallized sugar or common granulated sugar. Then it stands again a couple of days exposed to draft, is dipped in crystallized sugar and packed in a tin or wooden box lined with parchment paper and with layers of the same paper placed between the layers of paste.

The paste can be kept thus and served as dessert, and as garnishing on creams and custards, frozen creams, large cakes, etc.

Apricot Paste. 1 lb. powdered sugar to 1 lb. fruit pulp. Rub the fruit pulp through a purée strainer and weigh it. Add the sugar, put it over a slow fire, and cook until very thick, so that when a spoon has been passed through it the mess does not run together immediately. Then pour the paste upon flat dishes which have been rubbed with oil, and allow it to dry. Cut and pack in layers as directed above.

In the same manner raspberry, strawberry, and currant pastes are made.

Quince Paste. ¾ lb. powdered sugar for each pound of fruit pulp. Wipe the fruit, cut into quarters, remove flower and core, and cook in water until very tender. After rubbing the pulp through a sieve, weigh it and add the required amount of sugar. It is then cooked until very thick. Scalded and chopped nut kernels may be added. The pulp remaining after the juice has been extracted for quince jelly may be used also.

Gooseberry Paste. 1 lb. powdered sugar for each pound of fruit pulp. Use part ripe and part slightly-underripe berries. Cook as previously described.

This paste may be colored before it is poured out. Different flavors also can be added to the gooseberry as well as chopped or sliced almonds or other nuts.

Apple Paste.[1] ½ lb. powdered sugar to 1 lb. pulp as rubbed through a sieve. For this product apples that are of lower grade than is required for some other purposes can be used. Cut the apples into quarters. Remove flower, stem and core. Put fruit into cold water until it is ready to be cooked. Boil tender under cover and over a very low fire in order not to scorch. Rub the tender apples through a coarse sieve, weigh, and put in the kettle to be cooked with the sugar under constant stirring until it is rather firm. It can be varied in taste by the aid of different additions, as, for instance, vanilla, peppermint, or orange flavor, or cooked with either finely cut citron, finely cut lemon peel, or blanched and cut nut kernels. The paste is poured out, dried, and kept as the others.

Other fruit pastes can be made of cherries, plums, kumquats, guavas, and other tropical fruits.

It is often advisable to make several different pastes. When nearly dry (before cutting) place different colored or different flavored layers on top of each other as in a layer cake. With a sharp knife cut in one-half inch strips through all layers and dry.

Tomato Paste.

1 qt. thick strained tomato pulp.	½ tsp. salt.
1 slice onion.	1 tsp. sugar.
4 tbsp. chopped sweet red pepper pulp, or 1 tsp. paprika.	1 tbsp. mixed spices.

Cook spices, tied in bag, with tomato pulp in a pan over boiling water for about three hours, or until the paste is thick enough to hold the shape of spoon when

[1] The recipes for the fruit pastes were furnished by Mr. Frants P. Lund.

tested by dipping out a spoonful. Pack hot, process small jars 15 minutes in water bath at 212° F.

Preserving

A preserve is the product resulting when whole fruits are cooked in sirup until clear and transparent. When properly made the fruit in the preserve keeps its form, is plump, tender, clear, and of good color, the surrounding sirup being also clear and of proper density.

In making preserves the object is to have the fruit permeated with the sirup. It is well known that if two liquids of different densities be brought into contact with each other they tend to mix or diffuse until they equalize each other and become of the same density. This diffusion takes place through the cell walls of fruit or vegetables as readily as if they were not present between the fruit juice and the denser liquid. If fruit were placed at once in a very heavy sirup the difference in density between the two liquids would be so great that the sirup would absorb the fruit juice rapidly. This would cause the fruit to shrink and become shriveled and toughened. The sirup can then enter the fruit with great difficulty. In order to prevent shrinkage it is necessary to put fruit at first into this sirup and increase its density slowly enough for diffusion to take place and for the fruit to be permeated with the sirup. This is done by boiling the fruit in sirup or by alternately cooking and allowing the product to stand immersed in the sirup, the density of the sirup being increased by evaporation or by substituting a heavier sirup for the lighter one after each period of standing. It at any time the fruit shrivels or wrinkles, the sirup should

be made less dense by the addition of water. If this process be carried on gradually enough, the fruit may be completely saturated with sugar (as is the case with crystallized products) without shrinking.

In order to measure the density of liquids accurately and proceed with certainty, instruments called hydrometers have been devised. The one for the special purpose of measuring the density of sugar solution is known as a saccharometer. One type of saccharometer is a shot-weighted glass spindle graduated from 0 to 70 degrees, a Balling scale being used. When placed in water the spindle rests on the bottom of the vessel and the reading at the surface is zero. As the density is increased the spindle rises until when the solution is saturated with sugar at the temperature indicated the reading is 100. This saccharometer is inexpensive and is accurate enough for ordinary use. The Brix scale has the same gradations of density as the Balling, but is slightly more accurate, and costs more. It may be secured mercury-weighted. In using a saccharometer it is necessary to have a vessel of the same depth, in which to float it to make the reading. This must be very narrow in order not to demand so large a quantity of sirup to measure its density. A 250 cubic centimeter glass cylinder or a brass saccharometer cup is used.

For fruits like peaches, pears, watermelon rind, etc., preserving should be begun in sirup not heavier than 30° Balling (No. 3 in table, p. 226). Juicy fruits like berries can be put at the beginning into a heavier sirup, about 40° Balling, because the abundant juice of the fruit quickly reduces the density of the sirup before shrinking can take place. Finished preserves are packed in a sirup ranging from 50° to 60° Balling.

Sirup made with very acid fruits can be made heavier than pure sugar sirups without danger of crystallization, because the acid inverts some of the sugar, changing it to a form which will not crystallize readily.

Since long cooking injures the color and flavor of fruits, it is desirable to cook delicate fruits such as berries for as short a time as possible. Cooling rapidly after cooking gives preserves a better color and flavor than can be secured when they are packed hot. Standing immersed in sirup after cooking also helps to plump them. If berry preserves are covered for a brief time before removing from fire and the vessel left covered while cooling, the product will be more plump.

For cooling, shallow enamel trays or pans are desirable. Tin can not be used because fruits will discolor in it. Pack preserves cold, bring the sirup in which they have stood to boiling test, and if of proper density pour over the packed preserves, paddling to remove all air bubbles. If not of the right weight for packing, the sirup must be concentrated by boiling. To seal properly and to insure safety from mold it is necessary to process all preserves. Since they can be sterilized below the boiling point, processing at simmering (89° C.) for 30 minutes is preferable to boiling, because this temperature will give better color.

Fig Preserves. 6 qts. figs; 2 qts. sugar; 3 qts. water. Put the figs into a boiling soda solution (1 c. soda to 6 qts. of boiling water) and allow figs to remain about 5 minutes. Rinse the figs well by putting them through two cold baths. Drain the fruit thoroughly and add gradually to the skimmed sirup, which has been made by boiling the sugar and water together for 10 minutes. Cook rapidly until the figs are clear and

tender (about 2 hours). Carefully lift the fruit out and place in shallow pans. Cover the figs with the sirup and allow to stand overnight. Pack the cold figs in sterilized jars, fill each jar to overflowing with the sirup. Cap, clamp, and process.

Strawberry Preserves. 2 lbs. berries; 1½ lbs. sugar; 1 c. berry juice. Pick over the fruit and put together all firm, perfect berries. Slightly heat, crush, and strain the others to obtain the juice. Make a sirup of the sugar and juice, bring to the boiling point, remove from the fire, and cool before adding the berries. Add the berries a few at a time. Place again over the fire and heat slowly to boiling. Cook rapidly to 106° C. or 223° F. If a thermometer is not at hand, cook until berries are bright and transparent. Cool and pack cold in sterilized jars. Process at simmering (87° C. or 188° F.) to give best results in color and flavor. For 12-oz. or pint jars at this temperature, process for ½ hour. Other berries may be preserved in the same way.

Watermelon Preserves. Cut 1 lb. watermelon rind into inch squares. Allow to stand overnight in clear water. Drain and cover with about 30° sirup (2 c. sugar to 1 qt. water). Boil for 25 minutes. Let stand overnight immersed in sirup. Next morning add juice of ½ lemon and three slices of lemon additional for each pound. Cook until transparent (about 1 hour). Let stand until cold. Pack, add the sirup, garnishing with slices of lemon, cap, and process.

Gingered Watermelon Rind. To each pound of rind cut into 1-inch squares, add 2 qts. of water and 1 oz. slacked lime. Let stand in lime water overnight. Next morning drain and let stand 1 to 2 hours in fresh cold water. Drain well and boil rapidly in strong

ginger tea (1 oz. ginger to 1 qt. water) for 15 minutes. Drain, put into a 30° sirup made by using 1 pt. strained ginger tea with a qt. water and 1½ lbs. of sugar. Cook until tender and transparent (about 1½ hours). After boiling a half hour add half a lemon sliced thin. Place in shallow pans to cool, having the rind well covered with sirup. When cool arrange pieces attractively in jars, cover to overflowing with sirup. Cap, clamp, and process.

Uniform products can be more easily obtained by using the saccharometer to test the density of the sirup. The packing sirup for preserved and gingered watermelon rind and figs should be of 55° density, Balling saccharometer.

Cherry Preserves. 4 lbs. cherries; 3 lbs. sugar; 1 c. cherry juice. Make a sirup of the sugar and fruit juice, cool, add seeded cherries, and cook rapidly until fruit is clear and sirup is of the proper consistency. If a thermometer is used, finish cherry preserves at 106° to 108° C. or 223° to 226° F. Cool, pack into jars, and process as for other preserves.

Jelly Making

A good jelly should be bright, of good color, and clear. When removed from the glass, it should retain the shape of the mold. The jelly can be cut with a distinct cleavage, retaining the angles where cut. It should sparkle and be tender enough to quiver without breaking.

Fruit for Jelly Making. The juice from certain fruits, such as grape, apple, crab-apple, orange, kumquat, and currant is better suited for making a natural fruit jelly than juices from other fruits. The juices

from these fruits contain the properties necessary for jelly making. The best fruits for jelly making contain pectin and acid. Pectin, the fundamental jelly-making substance, does not exist in some fruits in sufficient amount to make jelly without the addition of pectin from some other source. The peach, strawberry, and cherry are examples of fruits which contain acid but are lacking in pectin. Pear, guava, and quince contain pectin but are deficient in acid. If the missing property be added to each of these fruits, a jelly with the color and flavor of the fruit selected can be made.

Extracting the Juice. Wash such fruit as berries, grapes, and currants in running water and add 1 cup of water for each pound of fruit. For apples, quinces, guavas, and such hard fruits, wash, slice, and add 3 c. water to each pound of fruit. The fruit should be cooked until tender, a small quantity of water being added to help extract the juice. The fruit juice will flow more freely when heated than when cold, and the cooking develops the pectin. As soon as the fruit is tender the liquid should be squeezed through a cheesecloth and then be allowed to drip, without pressure, through a flannel jelly bag. Over-cooking of the fruit is apt to result in a cloudy jelly. After cooling the juice to room temperature, test it to determine the amount of pectin present. This test gives some idea of the proper proportion of sugar to juice. Add 1 tbsp. 95 per cent grain alcohol to an equal volume of cooled fruit juice and shake gently. The effect of the alcohol is to bring together the pectin in a jelly-like mass. If a large quantity of pectin is present it will appear in one mass or clot when poured from the glass. This indicates that equal quantities of sugar and juice may be used. If the pectin does not slip from the glass

in one mass, less sugar will be required. A fair proportion is $\frac{3}{4}$ c. of sugar to 1 c. of juice. If the pectin is thin and much separated, $\frac{1}{2}$ c. of sugar allowed for each cup of juice will be sufficient.

Quantity of Juice to Cook. The quantity of juice to be cooked at one time will depend upon the size of the vessel and the methods of heating available. The capacity of the vessel used should be four times as great as the volume of juice to be cooked. If the attempt is made to cook a large quantity of juice at one time over a slow flame, there will be a loss of color and a decrease in the yield, partly due to the destruction of the pectin.

When to Add the Sugar. When the proportion of sugar to juice has been determined, measure the fruit juice and place over the fire to cook. When the juice begins to boil, add the sugar immediately and stir until the sugar is dissolved. By adding the sugar when the juice begins to boil, more time is given for the inversion of the sugar by the acids of the fruit and there is less danger of crystallization.

Cooking the Jelly. After the sugar has dissolved, the cooking should be as rapid as possible. Finished jelly can be obtained more quickly by rapid cooking. Long cooking will tend to darken the product and destroy the pectin, which will cause the finished jelly to be less firm.

Testing for the Finished Jelly. A thermometer can be used to great advantage to show when the jellying point is almost reached. No exact temperature can be given, because the jellying point differs with different fruits, with the quantity of sugar used, and with the same fruits at different seasons. In using a thermometer for cooking apple jelly it has been noted

that the temperature is seldom less than 105° C. or 221° F. or more than 106° C. or 223° F. While the temperature for guava jelly is approximately 108° C. or 226° F., a temperature less than this will give a sirupy product. With grape and currant jelly, between 106° C. and 107° C. or 223° F. and 224° F. will give the best results.

Since no definite temperature can be given for the finished jelly, the most convenient means of determining when it is finished is to test it with a spoon or paddle. Dip a spoon or wooden paddle in the boiling mass. Remove and cool by moving it back and forth for a few seconds and then allow the jelly to drop from it. As long as there is sirup present it will run or drop from the spoon. When the jellying point is reached, it will break from the spoon in flakes or sheets. When this jelly stage is reached, remove from the fire immediately and skim. Skimming at this point saves waste.

Filling Glasses. After skimming the jelly, pour at once into hot sterilized glasses and set aside to cool.

Cooling and Sealing. Cool as rapidly as possible, avoiding dust which will give contamination with mold. When the jelly is cold, cover it with melted paraffin. By running a pointed stick around the edge of the glass while the paraffin is still hot, a better seal can be obtained.

Storing. Jelly should be stored in a cool, dark, dry place. If jelly is stored for a long period of time, it will deteriorate in texture, color, and flavor.

Mistakes to Avoid. Soft Jelly. Jellies sometimes are sirupy because more sugar has been used than the fruit juices require or because boiling after the addition of sugar was not continued long enough to drive off excessive water.

Tough Jelly. Jelly is tough or stringy because too small an amount of sugar was used for the quantity of fruit juice taken or because the boiling was continued after the jellying point had been reached.

Crystals in Jelly. Crystals appear throughout the jelly because of an excess of sugar. When sugar is boiled with an acid for a sufficient length of time, it is changed into a form which does not crystallize. Crystals are found in jelly sometimes because the juice is boiled to too great a concentration before the addition of sugar; or in boiling, the sirup spatters on the side of the pan and dries, and in pouring the finished product, these crystals are carried into the glasses of jelly and in that way the jelly becomes seeded with crystals.

Cloudy Jellies. This may be due to having cooked the fruit too long before straining off the juice or to not having used sufficient care in straining the juice. Sometimes it is noticed in apple and crab-apple jelly that although it is clear when first made, the jelly becomes cloudy after a time. In these cases it usually is due to the use of partly green fruit, the starch in this fruit probably causing the cloudy appearance.

Apple Pectin.

1 pound apple pulp (or skins and cores).[1]
Juice of 1 lemon.
4 pounds water.

Boil for ½ to ¾ hour, press the juice through a cloth bag, then allow this juice to drain without pressure through a heavy flannel or haircloth jelly bag. This juice when cold should be tested with alcohol to determine the proportion of sugar to add to a volume of juice. Pectin can be bottled, processed for 15 minutes

[1] Only sound fruit should be used, not decomposed or worm-eaten fruit.

in a water bath at boiling, and kept until needed for jelly making.

Orange Pectin. Cut or scrape the yellow rind from the peel of the orange, the white portion remaining being passed through the food chopper and weighed. For each pound of this prepared peel add 2 lbs. of water and 4 tbsp. of lemon juice, mix thoroughly, and allow to stand 15 minutes. Then add 2 lbs. water, boil 10 minutes, let stand overnight. Next morning boil 10 minutes, allow to cool, press to remove juice, and then drain juice through a flannel bag. If not desired for immediate use, bottle and process as for apple pectin.

Mint and Orange (or Apple) Pectin Jelly.

1 pint concentrated orange (or apple) pectin juice.
1 lb. sugar.
2 drops oil peppermint.
2 drops green vegetable coloring.

Bring the orange or apple pectin juice to boiling, add sugar, and boil rapidly until the jellying point is reached. At this point 2 drops of green vegetable coloring matter is added, together with 2 drops of oil of peppermint. Stir thoroughly, and pour while hot into clean, sterilized jelly glasses. After a few moments the scum which rises to the top may be removed from the jelly easily with a spoon. Complete jelly as previously directed.

Strawberry and Orange (or Apple) Pectin Jelly.

½ pint concentrated orange (or apple) pectin.
½ lb. sugar.
½ pint strawberry juice.

Mix orange (or apple) pectin juice and the strawberry juice, bring to a boil, and add sugar. Con-

tinue boiling until the jellying point is reached. Pour immediately into hot sterilized jelly glasses and skim. When cold, pour hot paraffin over the jelly.

Pineapple and Orange (or Apple) Pectin Jelly. Add 1 pt. orange (or apple) pectin juice to 1 pt. pineapple juice which has been boiled for 10 minutes, add 1 lb. sugar, and continue boiling until the jellying point is reached. Pour immediately into hot sterilized jelly glasses and skim. When cold, pour hot paraffin over the jelly.

Apple Jelly.

1 lb. fruit . . 2 lbs. water	Boil together for ½ to ¾ hour and strain.

Take one pint strained juice. Determine amount of sugar to be added by the use of the alcohol test previously given. Bring the juice to a boil, add the sugar and cook as rapidly as possible until the jelly point is reached. Remove from the fire, skim, pour into hot sterilized glasses, and when cold cover with melted paraffin.

Grape Jelly.

4 lbs. grapes 1 lb. water	Crush and boil together for 20 minutes, press through a jelly bag, and allow to drain through a flannel bag.

Test the strained juice with alcohol to determine the proportion of sugar to use. Bring the grape juice to boiling, add sugar, and stir until the sugar is dissolved. Continue the boiling until the jelly point is reached. Remove from the fire and skim. Pour into hot sterilized glasses, seal, and store.

Blackberry Jelly.

4 lbs. blackberries.
1 lb. water.

Select 3 lbs. of ripe fruit and 1 lb. of underripe fruit, wash by running water over them, cap, crush, and add 1 pt. of water and boil 15 minutes. Press the pulp, and strain the juice through a flannel bag. Determine the correct amount of sugar to be added by the use of the alcohol test. Bring the juice to a boil, add sugar, and stir until the sugar is dissolved. Continue the boiling until the jelly point is reached. Remove from the fire and skim. Pour into hot sterilized glasses, seal, and store.

Contributions to the information on jelly making have been made by Dr. M. N. Straughn, of the Carbohydrate Laboratory, Bureau of Chemistry.

The instructions given in this bulletin were prepared mainly with a view to canning for home use. If products are packed for sale, the State Food Commissioner should be consulted as to the State regulations regarding such products, and if they are packed for interstate shipment additional information concerning the requirements under the Federal Food and Drugs Act should be secured from the Bureau of Chemistry of this Department.

U. S. DEPARTMENT OF AGRICULTURE
FARMERS' BULLETIN NO. 839

HOME CANNING BY THE ONE-PERIOD COLD-PACK METHOD[1]

Taught to Canning Club Members in the Northern and Western States

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Contribution from the States Relations Service
A. C. TRUE, Director

INTRODUCTION

If food products are left in their natural state, most of them spoil in a few hours or a few days owing to the growth on their surface or in their tissues of bacteria, molds, or other organisms of decay. If such organisms usually present in food can be killed and the entrance of other organisms prevented, the food can be kept in good condition practically indefinitely.

[1] A few products, such as soup stock and food combinations, owing to their physical condition, are packed hot. The general principles involved, however, are the same in all other regards.

It is this destruction of organisms and protection of the food from contamination that is accomplished by canning—the preparation and treatment before packing and process of placing food products in air-tight containers and sterilizing them.

Most home makers are familiar with some form of canning. Much of the canning practiced in homes, however, has been restricted to the putting up of fruits. The canning of vegetables and of meats has been considered until recently, by all but a relatively few persons, to be too complicated to be done satisfactorily in the home. By the method adopted for use in the home canning-club work of the United States Department of Agriculture in the Northern and Western States, however, it has been found to be a relatively simple matter to can practically any food product in the home, with ordinary kitchen equipment and with the expenditure of comparatively little labor. This method of canning is described in the following pages and is intended primarily for use in the Northern and Western States. By its use the time required for the treatment of food to prepare it for keeping is reduced to a minimum.

Preparations for Canning

The first steps in the canning method described in this bulletin, as in all canning, consist in the preparation and cleaning of containers and in the preparation of the products to be canned by washing, paring, trimming, and cutting into pieces where division is necessary.

Those engaged in the work should start with clean hands, clean utensils, clean, sound, fresh products,

and pure, clean, soft water. No vegetables or fruits which are withered or unsound should be canned. If possible, only fruits and vegetables picked the day of canning should be used. Peas and corn, which lose their flavor rapidly, should be canned, in fact, within 5 hours if a choice product is desired.

Before the preparation of the products is begun the containers should be washed. If glass or crockery jars are used, they should be placed in a vessel of cold water over a fire to heat. They will then be hot and ready for use when the products have been prepared for packing.

All grit and dirt should be washed carefully from the materials to be used. All products should be graded especially for ripeness. Large fruits and vegetables should be pared if necessary, and small fruits, berries, and greens picked over carefully.

Steps in Canning

After the materials have been cleaned and put into the shape in which they are to be canned, and containers have been cleaned and tested, the canning procedure for most products by the one-period cold-pack method consists of five steps—scalding or blanching, cold-dipping, packing, processing, and sealing. In canning berries and all soft fruits the blanching is dispensed with.

The products to be canned are blanched or scalded usually by being placed, in a cheese-cloth bag or dipping basket, into boiling water and allowed to remain there from 1 to 15 minutes, depending on the kind of product. In the case of greens and green vegetables, however, the scalding is accomplished most satisfactorily

in steam, as volatile oils and other substances remain in the food under this treatment. Such products may be put into a colander, set over a vessel of boiling water and covered as tightly as possible. Better results may be obtained, however, by the use of a steam cooker.

As soon as the product is removed from the boiling water or steam, it should be dipped into cold, clean water and immediately removed and drained for a few moments. The temperature of the water used for cold dipping should be as low as possible.

The product should be packed carefully into hot jars as soon as removed. In the case of fruits, boiling hot sirup or hot water is then added. In the case of vegetables, hot water usually is used and salt is added for seasoning. The scalded rubbers and tops of jars are put into place, the tops of cans sealed, and the containers are placed in a hot-water bath, pressure cooker, or other similar device for processing.

Processing is the final application of heat to sterilize the product and is continued for a period determined by the character of the product and the kind of apparatus used (see time schedule pp. 283–286). The containers should be placed in the processing vessel as soon as they are filled.

Immediately after the termination of the processing period, while the products are still hot, glass and similar containers must be sealed.

Jars should then be placed in a tray upside down to cool, and closely examined for leaks. If leakage occurs, the covers should be tightened until they are completely closed.

Tin cans may be cooled by plunging them in cold water. When the packed containers are thus cooled, they should be stored in a cool, dry place not exposed

to freezing temperature. Most products packed in glass jars will bleach or darken if exposed to light. It is well, therefore, to wrap jars in paper. From time to time, especially during very hot weather, both glass jars and tin cans should be examined to make certain that there are no leaks, swellings, or other signs of fermentation.

Equipment Required

Whatever type of apparatus is used for processing or sterilizing, a number of utensils are needed for properly handling the products during the proceeding steps. These include five or six acid-proof pans with covers for use in handling and blanching acid fruits, two tablespoons, one set of measuring spoons, one wire basket or several yards of cheese-cloth for use in blanching, six wiping cloths, two hand towels, one duplex fork for lifting hot jars, several sharp paring knives, a generous supply of clean hot and cold water, a garbage pail for scraps, and a good stove or other heating device.

For processing, home canners may choose from among several types of apparatus, according to their needs and means. The outfits in common use are of five general types:

1. Homemade Outfits

Homemade outfits are constructed of such utensils as wash boilers, tin pails, milk cans, metal washtubs, and lard pails. Such canners should have well-fitting covers and false bottoms or lifting platforms of metal or wood. The latter are to support jars or cans to prevent direct contact with heat and also to permit a free circulation of water and steam around and under the containers.

2. Hot-water-bath Commercial Outfits

Hot-water-bath commercial outfits are constructed usually for outdoor work, and have a sterilizing vat, lifting trays, fire box, and smoke pipe, combined in one piece. They are light and convenient, and are planned as portable outfits. The products should be sterilized in such outfits in completely sealed tin cans or partially sealed glass jars immersed in boiling water. The only advantage of these outfits over the homemade devices is that they are more convenient and have all the necessary equipment for operation. Both the homemade and hot-water commercial canners are classed as hot-water-bath outfits.

3. Water-seal Outfits

Water-seal outfits consist of a double-walled bath (*a*) and cover (*b*) which projects down into the water between the outer and inner walls, thus making three tin or galvanized metal walls, and two water jackets between the sterilizing vat and outer surface of the canner. A higher temperature may be maintained more uniformly with such an outfit than with the hot-water-bath outfits, since the free escape of steam is prevented and a slight steam pressure is maintained. The water-seal outfit may prove more economical of heat, especially in the canning of vegetables and meats, where high temperatures are necessary for complete sterilization.

4. Steam-pressure Outfits

Steam-pressure outfits are made to carry from 5 to 30 pounds of steam pressure, and are equipped with a steam-tight sterilizer, lifting crate, thermometer or pressure gauge, safety valve, and steam pet cock. The

pressure canner may be regulated easily so as to maintain different temperatures. It is thus adaptable for use in sterilizing various vegetables and food products.

5. Aluminum Pressure Cookers

Aluminum pressure cookers are combination outfits for general cooking purposes which are used also for home canning of fruits, vegetables, and meats. They may be used for canning during the canning season and as cookers during the entire year. As a type, these pressure cookers are light in construction and economical of heat. They are made entirely of aluminum and will carry as high as 30 pounds steam pressure. They are equipped with a steam-pressure gauge, safety valve, and pet cock, as are steam-pressure outfits.

Operation of Hot-water Bath and Water-seal Outfits

Difficulties in the operation of hot-water bath canning outfits may be avoided if the following rules are observed:

(1) Support the jars on a perforated platform sufficiently to permit the circulation of water under and around the jars.
(2) Have the water cover the tops of the jars by at least 1 inch.
(3) Count time as soon as the water begins to boil vigorously.
(4) Remove the jars from the water and tighten the covers as soon as the time is up.

Liquid may be lost from the jars during the sterilizing period if the water in the canner does not cover the tops of the jars, if the covers to the jars are adjusted too loosely, or if the platform in the bottom of the

canner does not permit the water to circulate underneath. Towels, excelsior, newspapers, hay, and the like are unsatisfactory for use in the bottoms of hot-water-bath outfis. Use a slat or perforated platform.

Operation of Steam-pressure Canners

To secure the best results in the operation of steam-pressure canners, the following precautions should be observed:

(1) Place each jar in hot water or in the canner as soon as packed.

(2) Have the water come to the platform, but not above it; add hot water occasionally to prevent its boiling dry.

(3) Have the canner absolutely steam-tight.

(4) When the canner has been filled, fasten the opposite clamps moderately tight; then tighten each pair of clamps fully.

(5) Allow the pet cock to remain open until live steam escapes from it.

(6) Close the pet cock completely.

(7) Force the pressure to the required point before counting time.

(8) Maintain a uniform pressure during the sterilizing period. This may be done by turning down gas or oil flame or moving canner off the stove partially.

(9) Allow the canner to cool until the steam gauge registers zero before opening the pet cock.

(10) Remove the jars from the canner and tighten the lids as soon as the canner is opened.

Liquid will be lost from jars during the sterilizing period if steam leaks at the joint and around the fittings; if the pressure is allowed to fluctuate, as by

running up to 12 pounds, down to 7 pounds, and back to 10 pounds; if steam is allowed to blow from the pet cock during or at the close of the sterilizing period; if a vacuum forms in the canner; or if the wire bails on the glass-top jars are so loose that they will not go in with a snap.

Containers

The method of canning here described does not require the use of a particular type of container. Glass jars, crockery jars (with air-tight tops) or tin cans of practically any type may be used if they are carefully cleaned and properly handled and sealed. When products are canned for use in the home, glass jars are perhaps preferable to tin cans. Jars may be sealed without the use of special apparatus and may be used over and over again if properly taken care of and if new rubbers are used each time. Tin cans, on the other hand, must be thrown away after being opened.

Tin cans, however, have certain advantages. They exclude light and so prevent bleaching, and they may be handled, packed, and transported more safely then glass jars. When products are canned for sale, tin cans are preferable except for local use in some sections and for fancy trade.

The use of specific types of containers and the necessary steps to be taken in testing, preparing, sealing, cooling, and storing them are discussed in an appendix to this bulletin.

Number of Cans or Jars per Bushel of Fruit or Vegetables

The following table shows the approximate number of cans or jars that can be filled per bushel of various fruits and vegetables:

CANS OR JARS PER BUSHEL OF VARIOUS FRUITS AND VEGETABLES

Product (1 Bushel).	No. 2 Cans (Pint Jars).	No. 3 Cans (Quart Jars).	Product (1 Bushel).	No. 2 Cans (Pint Jars).	No. 3 Cans (Quart Jars).
Windfall apples...	30	20	Tomatoes........	22	15
Standard peaches..	25	18	Shelled lima beans.	50	30
Pears............	45	30	String beans.....	30	20
Plums............	45	30	Sweet corn.......	45	25
Blackberries......	50	30	Shelled peas......	16	10
Windfall oranges:			Sweet potatoes...	30	20
Sliced..........	22	15			
Whole..........	35	22			

Legal Restrictions upon the Sale of Canned Products

If home-canned products are to be sold, certain legal restrictions which are placed upon the sale of canned goods must be observed. If they are to be sold wholly within the State, information concerning the State food laws should be obtained by writing to the State Food Commissioners or the State Board of Health. If the products are to be shipped in interstate commerce, information should also be obtained concerning Federal laws and regulations by writing to the Bureau of Chemistry, United States Department of Agriculture, Washington, D. C. Products made and sold wholly within the District of Columbia or the Territories are also subject to the Federal Food and Drugs Act.

Altitude Changes and Home Canning

The directions given in this bulletin for canning all kinds of vegetables, fruits, soups, meats, and combinations are based upon an altitude from sea level to 1,000 feet and upon the use of the quart jar or container. If

using smaller jars, reduce the time a trifle; if using larger jars, increase the time.

For altitudes above 1,000 feet the time of sterilization should be increased at the rate of 10 per cent for each 500 feet.

Brines

Brines of various strengths are used in canning some vegetables. The table following shows the proportions of salt and water required to make brines of given percentage strengths.

TABLE FOR MAKING BRINES

Strength of Brine.	Salt Necessary.	Water Necessary.			Strength of Brine.	Salt Necessary.	Water Necessary.		
%	*Lb.*	*Gal.*	*Qt.*	*Pt.*	%	*Lb.*	*Gal.*	*Qt.*	*Pt.*
1	1	12	1	1	10	10	11	1	....
2	2	12	1	....	12	12	11	..	....
3	3	12	....	1	15	15	10	2	1
6	6	11	3	....	18	18	10	1	....
8	8	11	2	....	24	24	9	2	....

Seasoning

In seasoning foods it should be kept in mind that most vegetables as well as meats are injured in flavor and quality by an excessive use of salt for seasoning in the canning process. A little salt is very palatable, and its use should be encouraged, but it is better to add no salt in canning than to use too much. Salt can be added to suit the taste when canned goods are served.

Sirups

Sirups are employed usually in canning fruits. A formula much used in some sections for sirup is 3 quarts

of sugar to 2 quarts of water, boiled to a thin, medium-thin, medium-thick, or thick sirup. The formula sometimes called the Eastern formula is 3 quarts of water to 2 quarts of sugar, boiled to a thin, medium-thin, medium-thick, or thick sirup. The first formula may be used in canning all kinds of fruits delicate in flavor and texture and when sugar is low or reasonable in price. When sugar is high in price and the character of the fruit is such that less sugar is required, the Eastern formula may be used.

Sirups of the approximate densities desired may be made easily without regard to the table of sirup densities already given, and without the use of an instrument for determining density if the following points are kept in mind:

Thin sirup is sugar and water boiled sufficiently to dissolve all of the sugar, but is not sticky. Such sirup has a density of from 12 to 20 per cent.

Medium-thin sirup is that which has begun to thicken and becomes sticky when cooled on the finger tip or spoon (density of from 20 to 40 per cent).

Medium-thick sirup is that which has thickened enough to roll or pile up over the edge of the spoon when it is poured out (density of from 40 to 50 per cent).

Thick sirup is that which has become so thick that it is difficult to pour out of a spoon or container, but is not sugared (density of from 50 to 64 per cent).

Thin sirups are used for all sweet fruits such as cherries, peaches, apples, etc., that are not too delicate in texture and color. Medium-thin sirups are used in the canning of the medium-sweet fruits, such as blackberries, currants, dewberries, huckleberries, rasp-

berries, etc. Medium-thick sirups are used in the canning of all sour fruits, such as gooseberries, apricots, sour apples, etc., and delicately colored fruits, such as strawberries and red raspberries. Thick sirup is used in preserving and making all kinds of sun-cooked preserves.

How to Determine Sirup Density

Unsatisfactory results frequently follow the use of sirups which are not of the density best suited to the particular purpose for which they are employed. The following table gives the proportions of sugar and water required to prepare sirup of the desired density. No allowance has been made for evaporation during heating.

PROPORTIONS OF SUGAR AND WATER IN SIRUP OF DIFFERENT DENSITY

Desired Sirup Density.	Sugar.	Water.	Desired Sirup Density.	Sugar.	Water.
Per Cent.	*Pounds.*	*Quarts.*	*Per Cent.*	*Pounds.*	*Quarts.*
12	1½	5½	35	7	6½
15	3	8½	40	2	1½
18	4½	10½	50	2	1
24	6	9½	60	6	2
28	7	9	64	16	4½

Canning Fruit without Sugar

All fruits can be canned successfully for future use, for jelly making, pie filling, salad purposes, etc., without the use of sugar by simply adding hot water instead of the hot sirups. It has been found practicable also with certain vegetables to substitute sugar for salt in the canning process, and then add other seasoning to taste when serving.

In canning fruit without sugar, can the product the day it is picked. Cull, stem, seed, and clean fruit by placing in strainer and pouring cold water over it. Pack the product carefully in hot glass jars or tin cans until full. Use tablespoon, wooden ladle, or table knife for packing purposes. Pour boiling hot water over the product in the hot jar. Place rubbers and caps in position, not tight. If using tin cans, seal completely. Place product in the sterilizer, vat, or canner, and sterilize for the length of time given below according to the particular type of outfit used:

	Minutes.
Hot-water bath, homemade or commercial........	30
Water seal, 214°................................	20
5 pounds steam pressure.........................	12
10 pounds steam pressure........................	10

After sterilizing remove the filled containers. Seal jars; invert to cool and test the joints. Wrap in paper to prevent bleaching and store in a dry, cool place. If tin cans are used it will be found advantageous to plunge them into cold water immediately after sterilization to cool them quickly.

Canning Directions

Vegetables

Tomatoes. Scald 1½ minutes or until skins loosen. Cold dip. Remove stems and cores. Pack directly into cans or hot jars. Press down with tablespoon (add no water). Add level teaspoonful salt per quart. Put rubbers and caps of jars into position, not tight. Seal tin cans completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial............	22
Water seal, 214°................................	18
5 pounds steam pressure.........................	15
10 pounds steam pressure........................	10

Sweet Peppers. Use sweet green peppers. Place the peppers in the oven and bake them until the skins separate from the meat. Remove the skins. Pack them solid in hot glass jars or tin cans. Add water. Add 1 level teaspoonful of salt per quart. Put the rubbers and caps of jars in position, not tight. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	75
5 pounds steam pressure	60
10 pounds steam pressure	40

Remove the jars; tighten the covers; invert the jars to cool, and test the joints. Wrap the jars to prevent bleaching.

Pumpkin, Squash, Hominy, and Sauerkraut. Prepare and cut into convenient sections. Blanch 3 minutes. Cold-dip; pack closely in hot jars or cans. Fill with boiling water. Add level teaspoonful salt per quart. Put rubbers and caps of jars into position, not tight. Seal tin cans completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	120
Water seal, 214°	90
5 pounds steam pressure	60
10 pounds steam pressure	40

Sweet Corn. Remove husk and silk. Blanch 5 minutes on cob. Cold-dip; cut corn from cob and pack directly in hot jars or cans (¼ inch of top). Fill with boiling water. Add level teaspoonful salt per quart. Put rubbers and caps of jars into position, not tight. Seal tin cans completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	180
Water seal, 214°	120
5 pounds steam pressure	90
10 to 15 pounds steam pressure	60

Corn seems to give home canners more trouble than do most products; but, with care and study, corn may be canned as

easily as any other product grown in the garden. A little experience in selecting the ear and the ability to recognize corn that is just between the milk and the dough stage are important. Cut the corn from the cob with a sharp, thin-bladed knife, and pack it at once into sterilized jars. Best results can be obtained when one person cuts the corn from the cob and one person fills the containers. If it is necessary for one person to work alone he should cut off sufficient corn to fill one jar, pour on boiling water, add salt, place the rubber and the cap in position, and put the jar into the canner or hot water at once. Corn expands a little in processing, and for this reason jars should not be filled quite full. Corn that has reached the dough stage before being packed will have a cheesy appearance after canning. Corn should never be allowed to remain in the cold-dip water, and large quantities should not be dipped at one time unless sufficient help is available to handle the product quickly. Water-logged or soaked corn indicates slow and inefficient packing.

When canning sweet corn on the cob, follow same directions but pack whole ears in jars instead of the cut-off corn.

Home Canning of Field Corn. This product is commonly known as corn club breakfast food, or 4-H brand food product. The corn should be selected between the milk and the dough stage. Wide-mouthed glass jars or tin cans should be used for canning this product. Avoid packing container too full, as the product swells during the sterilization period. The corn should be canned the same day it is picked from the field, if possible. The yellow field corn makes a yellow, butter-like food product when ground and canned. Avoid mixing the white and the yellow or Bloody Butcher corn in the same batch of food products. Secure a good grade of food chopper for grating the corn. Small 10-cent hand graters can be used, but work with these is too slow and tedious.

Blanch the corn ears in boiling hot water or live steam for 10 minutes. Remove and dip quickly in cold water. Cut the corn from the cob with a sharp, thin-bladed knife. Feed the corn to the food chopper and grind to a pulp. Cook this product in a kettle, add one level teaspoonful of salt to each quart, and a little butter, and sweeten a trifle with sugar. Cook (stir while cooking) until the product has assumed a thickened or paste-like mass. Then pack this product immediately in

tin cans or hot glass jars to ¼ inch of the top. Seal jars by placing rubber and cap in position and seal tin cans completely. Place jars and cans in wash boiler or sterilizer, and process for the length of time given below for the particular type of outfit used:

	Minutes.
Hot-water bath, homemade or commercial	180
Water seal, 214°	120
5 pounds steam pressure	60
10 or 15 pounds steam pressure	50

After this product has been sterilized and cooled and stored away, it will form a solid, butter-like mass, which when removed whole from the jars or pack may be cut in convenient slices for toasting, frying, and baking purposes, and will make a delicious food product, palatable, economical, and nourishing.

Vegetables such as Wax Beans, Stringless Beans, Okra, Green Peppers, Cabbage and Brussels Sprouts. String or hull. Blanch in live steam for 5 to 10 minutes. Remove and dip quickly in cold water. Pack in hot jars or tin cans and add boiling hot water until jars or tin cans are full. Add one level teaspoonful of salt to each quart. Put rubbers and caps of jars in position, not tight. Seal tin cans completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	120
Water seal, 214°	90
5 pounds steam pressure	60
10 pounds steam pressure	40

Lima Beans, Peas, and other Vegetables or Combinations of Them. Blanch in live steam for 5 to 10 minutes. Dip quickly in cold water. Pack immediately in hot glass jars or tin cans. Add boiling hot water to fill container. Add level teaspoonful salt per quart. Place rubbers and caps of jars in position, not tight. Seal tin cans completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	180
Water seal, 214°	120
5 pounds steam pressure	60
10 to 15 pounds steam pressure	40

Remove from container; tighten cover; invert to cool, and test the joints. Wrap in paper to prevent breakage, and store.

Peas. A cloudy or hazy appearance of the liquid when peas are keeping well, indicates that the product was roughly handled in blanching and cold-dipping, or that split or broken peas were not removed before packing. When peas are too old and blanching is not done carefully, the skin becomes cracked and the liquid cloudy. Some waters of high mineral content have a tendency to increase cloudiness, also to harden the peas.

Cauliflower. Use the flowered portion. Plunge it into cold brine (½ pound salt to 12 quarts of water). Allow the cauliflower to remain in this brine for 1 hour. Blanch it 3 minutes and dip quickly into cold water. Pack it in hot glass jars or tin cans. Fill with boiling water and add a level teaspoonful of salt per quart. Put rubbers and caps of jars in position, not tight. Cap and tip cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	60
Water seal, 214°	40
5 pounds steam pressure	30
15 pounds steam pressure	20

Remove the jars; tighten covers; invert jars to cool, and test the joints. Wrap the jars with paper to prevent bleaching.

Mushrooms. Caution: *Unless you are absolutely sure that you know a mushroom when you see it, do not run the risk of gathering and using for food what you think are mushrooms. A large numbers of persons are poisoned every year because of carelessness in this regard. Many very poisonous plants closely resemble edible mushrooms. Can mushrooms immediately after picking; if allowed to stand they become unfit for use. (See Farmers' Bulletin* 796, *Some Common Edible and Poisonous Mushrooms.)*

Wash and trim the mushrooms. If small, can them whole; if large, they may be cut into sections. Blanch the mushrooms in boiling water 5 minutes. Remove and plunge them quickly into very cold water. Pack in hot glass jars and add boiling water to cover; add one level teaspoonful of salt to the quart. Place rubbers and caps of jars in position, not tight. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	80
5 pounds steam pressure	50
15 pounds steam pressure	30

Remove the jars; tighten covers; invert jars to cool, and test the joints. Wrap jars in paper. If canning in tin, always use lacquered cans. Do not fail to blanch and cold-dip mushrooms before packing. After opening containers, remove the mushrooms immediately and use them as quickly as possible.

Root and Tuber Vegetables, Such as Carrots, Parsnips, Salsify, Beets, Turnips, and Sweet Potatoes. Grade for size, color, and degree of ripeness. Wash thoroughly, use vegetable brush. Scald or blanch in hot water sufficiently to loosen the skin. Dip quickly into cold water. Scrape or pare to remove skin. Pack whole vegetables, slices, or cross-section pieces in hot glass jars or tin cans. Add boiling hot water until full. Add level teaspoonful salt to quart. Place rubbers and tops of jars in position; seal partially, but not tight. Cap and tin cans completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	80
5 pounds steam pressure	60
10 pounds steam pressure	40

Remove jars from canner; tighten covers; invert to cool, and test joints. Wrap in paper, and store.

How to Prevent the Fading of Beets. Small beets that run 40 to the quart are the most suitable size for first-class packs. The older the beet the more chance there is for loss of color. When preparing the beet, leave on 1 inch of the stem and all of the tail while blanching. Blanch not more than 5 minutes, and cold-dip. The skin should be scraped from the beet, not peeled. Beets should be packed whole, if possible. Well-canned beets will show a slight loss of color when removed from the canner, but will brighten up in a few days.

Greens or Potherbs. A large number of cultivated and wild greens are edible, and if canned by this method will make a succulent and valuable food for the winter and spring months.

Among the cultivated greens are Swiss chard, kale, Chinese cabbage leaves, upland cress, French endive, cabbage sprouts, turnip tops, young tender New Zealand spinach, beet tops, dandelion, young tender dasheen sprouts, native mustard, Russian mustard, collards, and tender rape leaves. Among the wild greens are pepper cress, lamb's quarter, sour dock, smart-weed, sprouts, purslane, or "pusley," pokeweed sprouts, dandelion, marsh marigold, wild mustard, and milkweed (tender sprouts and young leaves).

Can greens the day they are picked. Wash clean, sort thoroughly, allowing no foreign weed leaves or other vegetable matter to remain. Rid the greens of all sand, dirt, dry and decayed or diseased leaves. Place the greens in a crate or cheese-cloth, and blanch in live steam, either in an improvised homemade steamer or a regular commercial steamer for 15 minutes. Remove the greens and plunge quickly into cold water. Place on the table and cut into convenient lengths. Pack tight in hot jars or tin cans. Add hot water to fill the container, and season to taste. The product will be slightly improved if a few strips of boiled bacon or chipped beef are added. A little olive oil also improves the flavor. If using glass jars, place rubbers and tops in position; partially seal. If using tin cans, cap and tip completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	120
Water seal, 214°	90
5 pounds steam pressure	60
10 pounds steam pressure	40

Remove from canner; tighten covers of jars; invert to cool, and test the joints. Wrap in paper to prevent bleaching, and store.

Vegetable Combinations

Corn and Tomato Combination. Blanch fresh corn on the cob 5 minutes. Cold-dip quickly. Cut the corn from the cob, cutting from tip to butt. Scald the tomatoes 1½ minutes and cold-dip. Remove the skin and core. Chop tomatoes into medium-sized pieces. Mix thoroughly 2 parts of tomatoes with 1 part of corn. Pack the mixture in hot glass jars or

enameled tin cans. Add a level teaspoonful of salt per quart. Put rubbers and caps of jars in position, not tight. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	120
Water seal, 214°	120
5 pounds steam pressure	60
15 pounds steam pressure	45

Remove the jars; tighten the covers; invert the jars to cool, and test the joints. Wrap the jars with paper to prevent bleaching.

Corn, Tomato, and String Bean Combination. Use 1 part of corn, 1 part of green string beans, and 3 parts of tomatoes. Blanch fresh corn on the cob for 5 minutes and cold-dip. Cut the corn from the cob, cutting from the tip to butt. Prepare string beans and cut them into convenient lengths. Blanch them 4 minutes and cold-dip. Blanch the tomatoes 1 to 3 minutes and cold-dip. Remove the skin and core. Cut the tomatoes into medium-sized pieces. Mix thoroughly. Pack the mixture in hot glass jars or enameled tin cans. Put rubbers and caps of jars in position, not tight. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	120
Water seal, 214°	120
5 pounds steam pressure	60
15 pounds steam pressure	45

Remove the jars; tighten the covers; invert the jars to cool, and test the joints. Wrap the jars with paper to prevent bleaching.

Fruits

Soft Fruits and Berries. These include apricots, blackberries, blueberries, cherries, currants, dewberries, figs, gooseberries, grapes, huckleberries, peaches, plums, raspberries, and strawberries.

After hulling, seeding, stemming, or skinning the fruit, place fruit in a strainer and rinse by pouring cold water over it.

Pack from strainer into hot jars or cans without crushing, using big spoon or ladle. Hot sirup previously prepared should be poured over the fruit at once. Before packing a second jar, place rubbers and caps in position, not tight. If using tin cans, seal completely. Enameled tin cans should be used for all highly acid berries. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	16
Water seal, 214°	12
5 pounds steam pressure	10
10 pounds steam pressure	5

Remove from canner; tighten covers; invert to cool, and test joints. Wrap in paper to prevent bleaching, and store.

Another Recipe for Strawberries. Canned by this recipe, strawberries will not rise to the top of the sirup. Use only fresh, ripe, firm, and sound berries. Prepare them and add 8 ounces of sugar and 2 tablespoonsful of water to each quart of berries. Boil slowly for 15 minutes in an enameled or acid-proof kettle. Allow the berries to cool and remain several hours or overnight in the covered kettle. Pack the cold berries in hot glass jars or enameled tin cans. Put the rubbers and caps of jars in position, not tight. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	8
Water seal 214°	6
5 pounds steam pressure	5
10 pounds steam pressure. (Do not use.)	

Remove the jars; tighten the covers; invert the jars to cool and test the joints. Wrap the jars with paper to prevent bleaching.

Hard Fruits: Apples, Pears, and Quinces. Remove skin and core. Cut into convenient slices or sections and drop into slightly salted cold water to keep from tarnishing. Blanch 1½ minutes. Cold-dip. Pack closely in hot jars or tin cans. Fill with hot sirup. Put rubbers and caps of jars into position, not tight. Seal tin cans completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	20
Water seal, 214°	12
5 pounds steam pressure	8
10 to 15 pounds steam pressure	6

Remove from canner; tighten covers; invert to cool, and test joints. Wrap in paper to prevent bleaching, and store.

Windfall Apples. Separate apples into two grades: Whole and reasonably sound and firm, first grade; all other apples (bruised, worm-eaten, and those containing decayed spots), second grade.

Whole Apples, First Grade. Pare and core. Drop whole apples in cold, slightly salted water, to keep from tarnishing. Pack whole apples in gallon tin cans or 2-quart hot glass jars. Add thin hot sirup until full. Place rubbers and tops of jars in position, not tight. Seal tin cans completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	16
Water seal, 214°	10
5 pounds steam pressure	8
10 pounds steam pressure	5

Remove from canner; tighten covers; invert to cool, and test the joints. Wrap in paper to prevent bleaching, and store.

Apple-pie Filling. The only difference between the canning of apples for pie filling and canning them whole, as by the directions above, is that the apples should be sliced immediately after paring into cold, slightly salted water. It will be found desirable to can first-grade apples either whole or quartered and second-grade apples sliced for use for pie filling. Second-grade apples and products prepared from poor stock should not be sold, of course, without labels which make the grade plain.

Fruit Juices

The fruit juice may be pressed out of fruit by means of a cider press, special fruit press, or other improvised presses; then heated in an acid-proof kettle up to 110° F. The fruit juice may then be poured into ordinary hot jars, hot bottles, or tin cans, and handled by the same directions as those for canning

of fruit itself. If poured into miscellaneous bottles, it is suggested that the fruit juice be sterilized as follows:

Make a cotton stopper and press into the neck of the bottle and leave during the sterilization period. Set bottles in boiling hot water up to the neck of the bottle, sterilize the fruit juice for 40 minutes at a temperature of 165° F. Remove the product, press cork in top over cotton stopper immediately. If the cork fits well, no paraffin need be used. If it is a poor cork, it may be necessary to dip the cork in a melted solution of wax or paraffin. Fruit juices and apple cider when handled in this way will not " flatten in taste " and will keep fresh for future use.

Sirup Made from Windfall Apples and Apple Cider[1]

Add 5 ounces of powdered calcium carbonate to 7 gallons of apple cider. Powdered calcium carbonate (carbonate of lime), or to give it its common name, precipitated chalk, is low-priced and harmless. Boil the mixture in a kettle or vat vigorously for 5 minutes. Pour the liquid into vessels, preferably glass jars or pitchers; allow to stand 6 or 8 hours, or until perfectly clear. Pour the clear liquid into a preserving kettle. Do not allow sediment at bottom to enter. Add to the clear liquid one level tablespoonful of lime carbonate, and stir thoroughly. The process is completed by boiling down rapidly to a clear liquid. Use density gauge or candy thermometer and bring the temperature up to 220° F. If a thermometer is not available, boil until bulk is reduced to one-seventh of the original volume. To determine whether the sirup is cooked enough, test as for candy—by pouring a little into cold water. If boiled enough it should have the consistency of maple sirup. It should not be cooked long enough to harden like candy when tested.

When the test shows that the sirup has been cooked enough, pour it into fruit jars, pitchers, etc., and allow it to cool slowly. Slow cooling is important, as otherwise the suspended matter will not settle properly and the sirup will be cloudy.

A good way to insure slow cooling is to stand the vessel, full of sirup, in a bucket or a wash boiler of hot water or to place them in a fireless cooker. The white sediment which settles out

[1] Apple-sirup directions furnished by H. C. Gore, Bureau of Chemistry.

during cooking is called " malate of lime " and is a harmless compound of lime with the natural acid of the apple. When the sirup is cooled, it should be stored in fruit jars, bottles, or jugs and crocks. Place the rubber and cap or cotton stopper or cork in position, and tighten. Place the container in boiling hot water and sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial...........	15
Water seal, 214°............................	10
5 pounds steam pressure......................	8
10 pounds steam pressure.....................	5

Remove jars and tighten covers. Invert to cool, and test the joints. Store for future use. This recipe is for making sirup primarily for home consumption. If the product is to be sold, legal requirements as to labeling should be ascertained and complied with.

Preserves

The one-period, cold-pack method of canning will be found especially helpful in eliminating the necessity of using paraffin or other wax tops for jellies, jams, and preserves. Three recipes and directions for canning jellies, jams, and preserves by this method follow to illustrate the application of the method. The use of containers with screw tops is recommended for these products. This will make unnecessary the expense and trouble of using paraffin, and will make the melting, molding, and deterioration of the top parts of the packs less likely.

Strawberry. Make a sirup of 1 quart of water and 11 pounds of sugar and cook it in an open kettle until the usual temperature for making candies, jellies, etc., is reached. If a candy thermometer is used cook the preserves until they reach a temperature of 265° F. A candy thermometer resigters 265° F. when placed in the sirup. Add 8 pounds of berries to the sirup. Cook very slowly, just at the boiling point. Stop the cooking when the thermometer registers 219° F. and pour into shallow pans to cool. Hasten the cooling by pouring sirup over the berries. Skim while cooking. Fill into hot jars. Put the rubber and cap in position, not tight. Cap and tip if using enameled tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial...........	20
Water seal, 214°..............................	15
Steam pressure (see note under cherry preserves).	10

Remove the jars; tighten the covers; invert the jars to cool, and test the joints. Wrap the jars in paper to prevent bleaching.

Cherry. Place 1 gallon of cold water in a kettle and add 10 pounds of pitted cherries. After bringing to boiling point continue to boil slowly for 18 minutes. Add 12 pounds of granulated sugar and cook until after the mixture has boiled violently for a few minutes. If a candy thermometer is used cook the mixture until a temperature of 219° F. is reached. Pack into hot glass jars. Put the rubber and cap in position, not tight. Cap and tip if using enameled tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial...........	20
Water seal, 214°..............................	15
Steam pressure................................	10

Note: when using pressure-cooker outfits on preserves, keep the valve open during the period of sterilization.

Sun Preserves

Strawberry. Select ripe, firm berries. Pick and preserve them the same day. Hull and rinse as described. Place them in a shallow platter in a single layer; sprinkle sugar over them; pour over them 50° sirup (same as strawberry preserves, but boiled thicker). Cover them with a glass dish or a plain window glass. Allow them to stand in the hot sun 8 or 12 hours. Pack them in hot screw-top jelly glasses. Put the rubber and cap in position, not tight. Cap and tip if using enameled tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial...........	20
Water seal, 214°..............................	15
Steam pressure (see note under cherry preserves).	10

Remove the jars; tighten the covers; invert the jars to cool, and test the joints. Wrap the jars in paper to prevent bleaching.

Soups

Soup Stock. Strip off the fat and meat from 25 pounds of beef hocks, joints, and bones containing marrow. Crack bones with a hatchet or cleaver. Reserve meat and fat for other use. Put the broken bones into a thin cloth sack, and place in a large kettle containing 5 gallons of cold water. Simmer (do not boil) for 6 or 7 hours. Do not salt while simmering. Skim off all fat. This should make about 5 gallons of stock.

LIST OF SUPPLIES NEEDED

25 pounds of beef bones.	5 gallons of water.

Pack hot into hot glass jars, bottles, or enameled or lacquered tin cans. Partially seal glass jars. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of out fitused:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	75
5 pounds steam pressure	60
10 to 15 pounds steam pressure	45

Vegetable Soup. Soak ¼ pound lima beans and 1 pound rice for 12 hours. Boil ½ pound pearl barley for 2 hours. Blanch 1 pound carrots, 1 pound onions, 1 medium-sized potato, and 1 red pepper for 3 minutes, and cold-dip. Prepare the vegetables and cut into small cubes. Mix thoroughly lima beans, rice, barley, carrots, onions, potatoes, and red pepper. Fill hot glass jars or enameled tin cans three-fourths full of the above mixture of vegetables and cereals. Make a smooth paste of ½ pound of wheat flour and blend in 5 gallons of soup stock. Boil 3 minutes and add 4 ounces salt.

LIST OF SUPPLIES NEEDED

¼ pound lima beans.	1 medium-sized potato.
1 pound rice.	1 red pepper.
½ pound pearl barley.	½ pound flour.
1 pound carrots.	4 ounces salt.
1 pound onions.	5 gallons soup stock.

Pour stock over vegetables and fill cans or hot glass jars. Partially seal glass jars. Cap and tip tin cans. Sterilize for the

length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	75
5 pounds steam pressure	60
10 to 15 pounds steam pressure	45

Cream of Pea Soup. Soak 8 pounds of dry peas overnight. Cook until soft. Mash fine. Add the mashed peas to 5½ gallons of soup stock and bring to boil. Pass the boiling liquid through a fine sieve. Make a smooth paste of ½ pound flour, and add paste, 10 ounces of sugar, and 3 ounces of salt to the soup stock. Cook until soup begins to thicken.

LIST OF SUPPLIES NEEDED

5½ gallons soup stock.
8 pounds dry peas.
3 ounces salt.
10 ounces granulated sugar.
½ pound flour.

Pack in hot glass jars or tin cans. Partially seal glass jars. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	75
5 pounds steam pressure	60
10 to 15 pounds steam pressure	45

Cream of Potato Soup. Boil 1½ pounds of potatoes, sliced thin, and 5 gallons of soup stock for 10 minutes. Add 3 ounces of salt, ¼ teaspoonful of pepper, and ½ pound of butter, and boil slowly for 5 minutes. Make 3 tablespoonfuls of flour into smooth paste and add to the above.

LIST OF SUPPLIES NEEDED

5 gallons soup stock.
1½ pounds thin-sliced potatoes (culls will do).
3 ounces salt.
¼ tablespoonful pepper (scant)
½ pound butter.
3 tablespoonfuls flour.

Cook 3 minutes and pack in hot glass jars or tin cans while hot. Partially seal glass jars. Cap and tip tin cans. Ster-

ilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial...........	90
Water seal, 214°..............................	75
5 pounds steam pressure.......................	60
10 to 15 pounds steam pressure................	45

Bean Soup. Soak 3 pounds of beans 12 hours in cold water. Cut 2 pounds of ham meat into $\frac{1}{4}$-inch cubes and place in a small sack. Place the beans, ham, and 4 gallons of water in a kettle and boil slowly until the beans are very soft. Remove the ham and beans from the liquor, and mash the beans fine. Return the ham and mashed beans to the liquor and add 5 gallons of soup stock and seasoning, and bring to boil.

LIST OF SUPPLIES NEEDED

5 gallons stock.
3 pounds beans.
2 pounds lean ham.
4 gallons water.
Salt and pepper to taste.

Pack into hot glass jars or tin cans while hot. Partially seal glass jars. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial...........	90
Water seal, 214°..............................	75
5 pounds steam pressure.......................	60
10 to 15 pounds steam pressure................	45

Okra Soup. Slice 8 pounds okra into thin disks. Blanch 10 minutes and cold-dip. Boil $1\frac{1}{2}$ pounds rice for 25 minutes. Mix the okra and rice and fill the cans or hot jars half full. To 5 gallons soup stock add 5 ounces salt, $\frac{1}{4}$ teaspoonful of coriander seed, and $\frac{1}{4}$ teaspoonful of powdered cloves, and bring to a boil.

LIST OF SUPPLIES NEEDED

5 gallons soup stock.
8 pounds okra.
$\frac{1}{4}$ teaspoonful coriander seed.
$\frac{1}{4}$ tsp. powdered cloves.
$1\frac{1}{2}$ pounds rice.
5 ounces salt.

Fill the remaining portion of the jars or cans with the seasoned food. Partially seal the glass jars. Cap and tip tin

cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial...........	90
Water seal, 214°................................	75
5 pounds steam pressure........................	60
10 to 15 pounds steam pressure..................	45

Tomato Pulp for Cream of Tomato Soup. Place tomatoes in a wire basket or piece of cheese-cloth and plunge into boiling water from 1 to 3 minutes. Plunge into cold water. Remove the skin and core. Place tomatoes in a kettle and boil 30 minutes. Pass the tomato pulp through a sieve. Pack in hot glass jars and tin cans while hot, and add a level teaspoonful of salt per quart. Partially seal glass jars. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial...........	30
Water seal, 214°................................	20
5 pounds steam pressure........................	18
10 to 15 pounds steam pressure..................	10

Chicken-soup Stock. Place 30 pounds chicken in 10 gallons of cold water and simmer over fire for 5 hours. Remove meat from bones, then strain. Add sufficient water to make 10 gallons of stock.

LIST OF SUPPLIES NEEDED

30 pounds chicken	10 gallons water.

Fill hot glass jars or enameled tin cans with the hot stock. Partially seal glass jars. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial...........	90
Water seal, 214°................................	75
5 pounds steam pressure........................	60
10 to 15 pounds steam pressure..................	45

Chicken Broth with Rice. For each gallon of soup stock use 12 ounces of rice. Boil the rice 30 minutes. Fill hot jars or enameled tin cans two-thirds full of rice and the remainder

with soup stock. Partially seal glass jars. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	75
5 pounds steam pressure	60
10 to 15 pounds steam pressure	45

Chicken Gumbo. Cut 2 pounds of ham into small cubes and boil 30 minutes. Mince 3 pounds chicken, and chop ½ pound of onions fine. Make a smooth paste of ½ pound of flour. Add above to 5 gallons chicken-soup stock. Then add ½ pound of butter and ¼ pound of salt and boil 10 minutes; then add 3 ounces of powdered okra mixed with 1 pint of water.

LIST OF SUPPLIES NEEDED

5 gallons chicken-soup stock.	½ pound butter.
3 pounds minced chicken.	¼ pound salt.
2 pounds ham.	½ pound flour.
½ pound onions.	3 ounces powdered okra.

Fill into hot glass jars or enameled tin cans while hot. Partially seal glass jars. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	75
5 pounds steam pressure	60
10 to 15 pounds steam pressure	45

Vegetables for Soup

If it is impracticable to obtain materials for making soup stock in the summer when vegetables are abundantly available, the vegetable portion of the soup may be canned alone. The preparation of soup from cans of such vegetable combinations will be a relatively simple matter whenever stock is available, as it should be in most households if meat refuse is properly utilized.

Soak 6 pounds of lima beans and 4 pounds of dry peas over night. Boil each ½ hour. Blanch 16 pounds of carrots, 6

pounds of cabbage, 3 pounds of celery, 6 pounds of turnips, 4 pounds of okra, 1 pound of onions, and 4 pounds of parsley for 3 minutes, and dip all in cold water quickly. Prepare the vegetables and chop them into small cubes. Chop the onions and celery extra fine. Mix all of the vegetables together thoroughly and season to taste.

LIST OF SUPPLIES NEEDED

16 pounds carrots (small)	4 pounds okra.
6 pounds cabbage.	1 pound onions.
3 pounds celery (stems and leaves)	4 pounds parsley.
6 pounds turnips.	4 pounds dry peas.
6 pounds lima beans.	Salt and pepper to taste.

Pack in hot glass jars or tin cans. Fill with boiling water. Partially seal glass jars. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	75
5 pounds steam pressure	60
10 to 15 pounds steam pressure	45

Meats

While meats may be canned successfully if directions are followed carefully, it is perhaps advisable for beginners in canning to start with vegetables and fruits, taking up the canning of meats only after thorough familiarity with the process described in this bulletin has been acquired. If canned meat products are to be offered for sale through interstate shipment, inquiry should be made of the United States Department of Agriculture and State food regulating agencies in regard to the steps which must be taken to comply with the United States meat-inspection regulations and local laws.

Poultry and Game Birds. Recipe No. 1. Kill fowl and draw at once; wash carefully and cool; cut into convenient sections. Place in wire basket or cheese-cloth and boil until meat can be removed from bones; remove from boiling liquid and remove meat from bones; pack closely into glass jars or enameled cans; fill jars with pot liquid, after it has been concentrated one-half; add level teaspoonful of salt per quart of meat, for seasoning; put rubbers and caps of jars into position, not tight. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Hours.
Water bath, homemade or commercial...........	3
Water seal, 214°............................	3
5 pounds steam pressure......................	2
10 to 15 pounds steam pressure................	1

Remove jars; tighten covers; invert to cool, and test joints. Wrap jars with paper.

Recipe No. 2. Kill fowl and draw at once; wash carefully and cool; cut into convenient sections; scald in boiling water and dip at once into cold water. Pack immediately into glass jars or enameled cans; fill with boiling water; add level teaspoonful of salt per quart; put rubbers and caps of jars into position, not tight. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Hours.
Water bath, homemade or commercial...........	3
Water seal, 214°............................	3
5 pounds steam pressure......................	2
10 to 15 pounds steam pressure................	1

Remove jars; tighten covers; invert to cool, and test joints. Wrap jars with paper to prevent bleaching.

Fresh Beef. Obtain fresh beef, cut into convenient pieces for handling (about $\frac{3}{4}$ pound in weight), and roast or boil slowly for $\frac{1}{2}$ hour. Cut into small pieces, remove gristle, bone, and excessive fat, and pack directly into hot glass jars; fill with gravy from the roasting pan or pot liquid concentrated to one-half its volume; put rubber and cap into position, not tight. Sterilize for the length of time given below for the particular type of outfit used:

	Hours.
Water bath, homemade or commercial	3
Water seal, 214°	3
5 pounds steam pressure	2
10 to 15 pounds steam pressure	1

Corned Beef. After beef has been properly corned for required time, remove the meat from the brine; soak for 2 hours in clear water, changing the water once; place in a wire basket and boil slowly for ½ hour; remove from the boiling water, plunge into cold water, and remove gristle, bone, and excessive fat. Cut meat into small pieces and pack closely into hot glass jars or enameled cans. Put rubbers and caps of jars into position, not tight. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Hours.
Water bath, homemade or commercial	3
Water seal, 214°	3
5 pounds steam pressure	2
10 to 15 pounds steam pressure	1

Specially Prepared Meats

Spring Chicken, Fried. After cleaning and preparing spring frys, season and fry as though preparing for serving directly on the table. Cook until the meat is about three-fourths done. If a whole spring chicken, break the neck and both legs and fold around body of chicken. Roll up tight, tie a string around the chicken, and drop this hot, partially fried product into hot quart glass jar or enameled tin can. A quart jar will hold two to four small chickens. Pour liquid from the griddle or frying pan into the container over the chicken. Place rubbers and caps of jars into position, not tight. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	60
5 pounds steam pressure	40
10 to 15 pounds steam pressure	30

In a similar way any fowl or wild game may be prepared by frying, oven-baking, roasting, or stewing. The meat products

which may be canned in this way include beef, pork, Hamburg steak, sausage, venison, rabbit, squirrel, raccoon, opossum, lamb, and all types of sea food. All may be packed after cooking three-fourths done in any desired way. Hot glass jars or enameled tin cans may be used. When the products are packed while hot in the containers the hot liquids, gravies, dressings, etc., or hot water should be poured over them. Put rubbers and caps of jars into position, not tight. Cap and tip tin cans. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	60
5 pounds steam pressure	40
10 to 15 pounds steam pressure	30

Tighten jars and invert to test joints.

Camp Rations

Ration No. 1. Products required for mixture:

4 pounds rice.	1 pound cheese (or ½ lb. butter).
1 pound fresh green peppers.	1 pound fresh pork.
4 Chili peppers.	4 Spanish peppers.
4 cloves or 2 garlic.	8 level teaspoonfuls salt.
4 quarts tomatoes.	4 quarts water.

Put the meat, peppers, and garlic through a food chopper. Mix with tomatoes, water, and salt. Cook on slow fire, simmering for 45 minutes. Soak rice in salted water for 20 minutes. Rinse with cold water at once. Mix this product with the sauce without straining. Grind or grate cheese and mix thoroughly with all the other products.

To can this ration, the mixture should be packed in hot glass jars or tin cans while hot. Place rubbers and caps of jars in position, not tight. Cap and seal tin cans completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	60
5 pounds steam pressure	50
10 pounds steam pressure	40

Remove jars or cans; tighten glass jar covers; invert to cool, and test joints. Wrap jars to prevent bleaching, and store.

Ration No. 2. Products required for mixture:

1 lb. rice or hominy, cracked.
1 teaspoonful salt.
½ pound bacon or chipped beef cut into small pieces.
1 lb. mixed equal parts carrots, onions, beans, Irish potatoes.
2 quarts water or milk (or 1 quart water and 1 qt. milk).
½ pound sweet green peppers cut fine.
1 pint strained tomatoes.
Season with celery salt or celery seed.

Cook rice or hominy, water or milk, and salt in a double boiler until the rice or hominy is soft. Bacon or chipped beef, green peppers, and the strained tomatoes should be cooked or boiled separately. Then add to this mixture the 1-pound mixture of vegetables and season with mixed spices. Cook this vegetable combination until done. Mix at once rice, bacon, green peppers, etc. Stir this well into the mixture.

The product to be canned should be hot and thoroughly mixed. Pack mixture into hot glass jars or tin cans at once to ⅛ inch of top. Place rubbers and caps of jars in position, not tight. Seal tin cans completely. Sterilize for the length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	60
5 pounds steam pressure	50
10 pounds steam pressure	30

Remove jars; tighten covers; invert to cool, and test joints. Wrap and store.

Ration No. 3. One-pound pack. Products used:

8 ounces beef.
2 ounces potatoes.
2 ounces onions.
1 ounce carrots.
1 ounce beans.
2 ounces beef gravy.

Parboil the beef in kettle with thin gravy for 30 minutes. Cut up potatoes, onions, and carrots into small sections; add the beans. Place entire mixture in kettle; add the gravy, season to taste. Stir mixture, and cook for 10 minutes.

TIME-TABLE FOR SCALDING, BLANCHING, AND STERILIZING VEGETABLES, SOUPS, FRUITS, AND MEATS.

Products by Groups.	Scald or Blanch.	Hot-water-bath Outfits at 212°.	Water-seal Outfits, 214°.	Steam Pressure 5 to 10 Pounds.	Pressure Cooker, 10 to 15 Pounds.
SPECIAL VEGETABLES					
Tomatoes	1½	22	18	15	10
Pumpkin	3	120	90	60	40
Squash	3	120	90	60	40
Hominy	3	120	90	60	40
Sauerkraut	3	120	90	60	40
Corn, sweet	5	180	120	90	60
Corn, field	10	180	120	60	50
Mushrooms	5	90	80	50	30
Sweet peppers	5	90	75	60	40
POD VEGETABLES AND OTHER GREEN PRODUCTS					
Beans, wax	5–10	120	90	60	40
Beans, stringless	5–10	120	90	60	40
Okra	5–10	120	90	60	40
Peppers, green or ripe	5–10	120	90	60	40
Cabbage	5–10	120	90	60	40
Brussels sprouts	5–10	120	90	60	40
Cauliflower	3	60	40	30	20
ROOT AND TUBER VEGETABLES					
Carrots	5	90	80	60	40
Parsnips	5	90	80	60	40
Salsify	5	90	80	60	40
Beets	5	90	80	60	40
Turnips	5	90	80	60	40
Sweet potatoes	5	90	80	60	40
Other roots and tubers	5	90	80	60	40
COMBINATIONS AND SOUP VEGETABLES					
Lima beans	5–10	180	120	60	40
Peas	5–10	180	120	60	40
Vegetable combinations	5–10	120	120	60	45

TIME-TABLE FOR SCALDING, BLANCHING, AND STERILIZING VEGETABLES, SOUPS, FRUITS, AND MEATS—*Continued*

Products by Groups.	Scald or Blanch.	Hot-water-bath Outfits at 212°.	Water-seal Outfits, 214°.	Steam Pressure 5 to 10 Pounds.	Pressure Cooker, 10 to 15 Pounds.
GREENS, DOMESTIC OR WILD					
Swiss chard	15	120	90	60	40
Kale	15	120	90	60	40
Chinese cabbage leaves	15	120	90	60	40
Upland cress	15	120	90	60	40
French endive	15	120	90	60	40
Cabbage sprouts	15	120	90	60	40
Turnip tops (young, tender)	15	120	90	60	40
Spinach, New Zealand	15	120	90	60	40
Asparagus	15	120	90	60	40
Spinach	15	120	90	60	40
Beet tops	15	120	90	60	40
Dandelion, cultivated	15	120	90	60	40
Dandelion, wild	15	120	90	60	40
Dasheen sprouts (tender)	15	120	90	60	40
Mustard, native	15	120	90	60	40
Mustard, Russian	15	120	90	60	40
Mustard, wild	15	120	90	60	40
Collards	15	120	90	60	40
Rape (tender leaves)	15	120	90	60	40
Pepper cress	15	120	90	60	40
Lamb's-quarter	15	120	90	60	40
Sour dock	15	120	90	60	40
Smartweed	15	120	90	60	40
Sprouts	15	120	90	60	40
Purslane, or " pusley "	15	120	90	60	40
Pokeweed sprouts	15	120	90	60	40
Marsh marigold	15	120	90	60	40
Milkweed (tender sprouts and young leaves)	15	120	90	60	40
SOFT FRUITS AND BERRIES					
Apricots	1–2	16	12	10	5
Blackberries	......	16	12	10	5
Blueberries	......	16	12	10	5
Cherries	......	16	12	10	5
Currants	......	16	12	10	5

TIME-TABLE FOR SCALDING, BLANCHING, AND STERILIZING VEGETABLES, SOUPS, FRUITS, AND MEATS—*Continued*

Products by Groups.	Scald or Blanch.	Hot-water-Bath Outfits at 212°.	Water-seal Outfits, 214°.	Steam Pressure 5 to 10 Pounds.	Pressure Cooker, 10 to 15 Pounds.
SOFT FRUITS AND BERRIES *Continued*					
Dewberries	......	16	12	10	5
Figs	1–2	16	12	10	5
Gooseberries	1–2	16	12	10	5
Grapes	......	16	12	10	5
Huckleberries	......	16	12	10	5
Peaches	1–2	16	12	10	5
Plums	......	16	12	10	5
Raspberries	......	16	12	10	5
Strawberries	......	16	12	10	5
Citrus fruits	1–2	12	8	6	4
Fruits without sugar sirup	......	30	20	12	10
HARD FRUITS					
Apples	1½	20	12	8	6
Pears	1½	20	12	8	6
Quinces	1½	20	12	8	6
Windfall apples (pie filling)	......	12	10	8	5
Quartered apples (salad)	......	12	10	8	5
Whole apples, pared and cored	......	16	10	8	5
Apple sirup	......	15	10	8	5
Fruit juices	......	15	10	8	5
Preserves, after preparation and filling	......	20	15	10	
MEATS					
Uncooked					
Poultry and game	......	180	180	120	60
Beef	......	180	180	120	60
Corn beef	......	180	180	120	60
Prepared young meats					
Spring frys	......	90	60	40	30
Fried meats	......	90	60	40	30
Baked meats	......	90	60	40	30
Stewed meats	......	90	60	40	30
Roast meats	......	90	60	40	30

TIME-TABLE FOR SCALDING, BLANCHING, AND STERILIZING VEGETABLES, SOUPS, FRUITS, AND MEATS—*Continued*

Products by Groups.	Scald or Blanch.	Hot-water-Bath Outfits at 212°.	Water-seal Outfits, 214°.	Steam Pressure 5 to 10 Pounds.	Pressure Cooker, 10 to 15 Pounds.
MEATS—*Continued*					
Prepared mature meats					
Wild game	......	90	60	40	30
Fowls	......	90	60	40	30
Cockerels	......	90	60	40	30
Fried meats	......	90	60	40	30
Baked meats	......	90	60	40	30
Stewed meats	......	90	60	40	30
Roast meats	......	90	60	40	30
Fish	5	180	160	120	90
Shellfish	5	180	160	120	90
CAMP RATIONS					
No. 1	......	90	60	50	40
No. 2	......	90	60	50	30
No. 3	......	90	60	50	40
SOUPS					
Cream of tomato soup	......	30	20	18	10
All other soup combinations and soup stock	......	90	75	60	45

To can the mixture, pack it hot into hot glass jars or tin cans to ⅛ inch of top. Place rubbers and tops of jars in position, not tight. If using tin cans, seal completely. Sterilize for length of time given below for the particular type of outfit used:

	Minutes.
Water bath, homemade or commercial	90
Water seal, 214°	60
5 pounds steam pressure	50
10 pounds steam pressure	40

Remove jars or cans; tighten jar covers; invert to cool, and test joints. Wrap and store.

All vegetables, meats, and other food products used in the soup combinations should be prepared and treated prior to sterilization in the same way as when canned separately, and then mixed, packed, and thoroughly sterilized.

This time schedule is based upon the 1-quart pack and upon fresh products at altitudes up to 1,000 feet. For higher altitudes, increase the time 10 per cent for each additional 500 feet.

When processing fruits in steam-pressure canners, not over 5 pounds of steam pressure should be used.

When processing vegetables, do not use over 15 pounds of pressure.

Special Canning Precautions and Suggestions

Mold on Canned Goods

Mold may develop on canned goods if the seal is defective; if, after sterilizing, the tops are removed from the jars to replace the rubber rings; and if the jars are kept in a damp place where the rubbers may decompose.

Shrinkage during Sterilization

Shrinkage may occur during sterilization because of improper and insufficient blanching and cold-dipping, careless packing, poor grading, sterilizing for too long a period, or lack of jugdment in the amount and size of product put into the container.

Blanching Greens

The proper way to blanch all greens or potherbs is in a steamer or in a vessel improvised to do the blanching in steam above the water line. If this is done, a high percentage of mineral salts and volatile oil is retained in the product.

Special Requirements of Corn, Peas, Beans, and Asparagus

Canned corn, peas, beans, and asparagus may show no signs of spoilage and still when opened have a sour

taste and a disagreeable odor. This specific trouble is known to the canner as "flat-sour," and can be avoided if the canner will use fresh product, that is, one which has not been gathered more than 5 or 6 hours, and will blanch, cold-dip, and pack one jar of product at a time, and place each jar in the canner as it is packed. The first jar in will not be affected by the extra cooking. When the steam-pressure canner is used the jars or cans may be placed in the retort, the cover placed in position, but not clamped down until the retort is filled. Rapid cooling of these products prevents over-cooking, clarifies the liquid, and preserves the shape and texture.

APPENDIX

Handling and Sealing Containers

Glass Jars

Glass jars of several types are available for use in home canning. The types in most general use, however, are those with metal screw-tops, those with glass and spring-tops, and those with suction seal tops. While large-necked bottles and jars not provided with sealing tops can not be used for canning, they can be used as containers for preserves, marmalades, jellies, and other fruit preparations in which heavy or thick sirups are used. Such jars can be capped with paper and paraffin, or, in the case of jellies and stiff marmalades, with paraffin alone.

Before food to be canned is prepared for packing, jars should be tested, washed, and placed in a vessel of cool water on a stove to heat. The jars should be kept hot in the water until needed for packing. To

test screw-top jars, place the top on the jar without a rubber, and screw down tight. If a case knife can be inserted easily between the top and the glass, the top usually is defective. Another test is to screw the top down lightly on a rubber and pull the rubber from its position. If, when released, the rubber ring returns to its position between the top and the jar, the top is defective.

If a glass top, placed on a jar without a rubber, rocks when pressed, it is defective. The wire bails which hold glass tops in place should go on with a snap even when the tightening lever on the clamp spring is up. If the bail is not tight it should be removed from the tightening lever and bent until it fits tightly. This tightening of the bail should be done every year.

Only good, elastic rubber rings should be used. Practically this means new rubbers, as rubbers seldom will stand use a second time. The product to be canned should be placed in jars while the jars are hot. Rubbers and tops should then be put in place, but the sealing levers should not be tightened until after processing.

Glass jars, of course, must be handled carefully to prevent breakage. Hot jars should not be brought into contact with cold metal, stone, or water, or placed in a draft of cold air. Cold jars should not be placed in hot water, nor have hot liquids poured into them. The wire bails of glass-top jars should not be so tight that the tops will be crushed when the levers are pressed down in sealing.

Crockery Jars

Several types of crockery jars which have rubber top and clamp spring adjustment for sealing hermetic-

ally may be purchased. These jars, in sizes ranging from 1 pint to 1 gallon, may be used successfully in connection with the one-period, cold-pack method of canning. They should be handled in the same manner as are the clamp-spring, glass-top jars. Crockery jars should be washed with special care since they do not show the presence of dirt as do glass jars. They should be heated thoroughly before they are filled with food products.

For all packs in crockery jars of more than 1 quart size, the time for sterilization should be increased 10 to 20 per cent over the sterilization period scheduled for glass jars of the same size.

This is necessary because the crockery jars will not transmit heat as rapidly as the thin glass jars or tin cans. On the other hand, they do not cool as rapidly as do the glass jars, thus giving the product a little longer period under high temperature. It is also possible when using crockery jars to plunge them into cold water a short while (but not immediately) after removal from the sterilizer in order to effect the rapid cooling of the product. When this rapid cooling system is used it will not be necessary to increase the time required for cooking.

Tin Cans

Most products may be packed in plain tin cans. A few products, however, should be packed in enameled cans in which the enamel prevents the products from acting chemically on the tin coating of the container. Enameled cans should be used for greens, beets, strawberries, cherries, pumpkin, squash, fish, poultry, and meat.

Tin cans are practicable for the home canning of

fruits, vegetables, greens, soups, and meats, and their use is considered by many persons to simplify the operation and make possible the accomplishment of more work in a given time. Products packed in tin cans are handled easily in transportation and storage.

SIZES OF TIN CANS

Several standard sizes of tin cans are in common use for home canning purposes and may be had in either sanitary or cap-and-hole type:

NUMBER, SIZE, AND DIAMETER OF OPENINGS OF TIN CANS

No. of Can.	Size of Can (Inches).	Diameter of Opening (Inches).
1	$2\frac{5}{8} \times 4$	$2\frac{1}{16}$
2	$2\frac{5}{16} \times 4\frac{9}{16}$	$2\frac{1}{16}$ or $2\frac{7}{16}$
3	$4\frac{1}{8} \times 4\frac{7}{8}$	$2\frac{1}{16}$ or $2\frac{7}{16}$
10	$6\frac{3}{16} \times 6\frac{7}{8}$	$2\frac{1}{16}$ or $2\frac{7}{16}$

TYPES OF TIN CANS

There are two general types of cans on the market that are used as containers for food.

The sanitary or rim-seal can consists of can and cover pressed into a definite shape. That part of the cover that comes in contact with the can is coated with a compound or fitted with a rubber film, paper gasket, or ring that makes a perfect seal when the cover is crimped on the can. The seal can be made only with a machine constructed for the purpose. No heat or solder is required to make the seal.

Special Rim-seal Cans. Several types of rim-seal cans differ from the ordinary sanitary can in construction. They are made for use in special machines.

Cap-and-hole Tin Cans. The cap-and-hole can con-

sists of a can and cover. The cover carries a rim of solder. The cap is fastened on the can by the application of heat, as described later.

USE OF MECHANICAL SEALERS FOR SANITARY OR RIM-SEAL CANS

In canning in tin cans to be sealed with mechanical sealers, the recipe is followed as for glass jars, and the boiling water or sirup poured over the product. The can should be sealed immediately after the boiling liquid is added. Two distinct operations are required to seal either the sanitary or the rim-seal can. When the can is placed in the machine and clamped into position the first roll is applied, while the can is revolved. This operation should be continued until the cover is locked into position on the can and the lap joint made. The second roll is then applied and the can revolved to close the joint and thus hermetically seal the can. These mechanical sealers are adjustable to handle No. 2, No. 2½, No. 3, and No. 10 sanitary cans. Complete instructions are furnished with the machines.

TESTING JOINT OR SEAL

To determine if the machine is adjusted properly, place three or four tablespoonfuls of water in a can, and seal. Hold the sealed can under the surface of hot water for three minutes. If air bubbles rise from the can, it indicates that the seal has not been made properly. Special rim-seal cans should be handled according to instructions of the manufacturer.

SEALING CANS

When tin cans are used as containers they are sealed by soldering, or, if of the "sanitary" type, by me-

chanical sealing machines, as described above. Cans must be sealed before they are processed. If solder is used, the equipment required includes a capping iron, a tipping copper, soldering flux, a small brush, a porcelain, glass, or stoneware cup in which to keep the soldering flux, sal ammoniac, a few scraps of zinc, solder, a soft brick for polishing irons, and a file. If a hand sealing machine and solderless cans are used, all other equipment and material are unnecessary.

Soldering Flux. Soldering flux is a solution of zinc in crude muriatic acid. It is used for cleaning the irons and for brushing the tin and solder surfaces, so that the solder will adhere to the tin. It may be made as follows: Place 2 or 3 ounces of muriatic acid (purchased at a drug store) in a porcelain, stoneware, or glass jar and add as much sheet zinc in small pieces as the acid will dissolve; when the zinc has dissolved, dilute the solution to twice its quantity with water and strain through a piece of cloth. Flux is always best when it has stood at least 12 to 16 hours before being used. Keep the flux well mixed and free from dust and dirt. Care should be taken not to spill the flux on clothing.

Soldering flux ready for use may be purchased at some drug stores and hardware stores. Sometimes a powdered rosin is used as a substitute for the flux. Recently a soldering paste has been manufactured which is desirable for use in canning work, because it is convenient and clean to handle.

Tinning the Capping Iron. Clean the iron with a file, brick, or knife; heat it sufficiently to melt a little solder in the sal ammoniac (5 or 10 cents' worth purchased at a drug store); then place the iron in the mix-

ture of sal ammoniac and solder, and rotate it until the soldering edge of the iron is thoroughly covered with the solder.

Tinning the Tipping Copper. The tipping copper is tinned in much the same way as the capping iron. Sometimes it is desirable, however, to file the tipping copper sufficiently to make it smooth and to correct the point. The copper should be filed to nearly a sharp point. All particles of smudge, burned materials, etc., should be removed from the iron before tinning. Heat the copper and rotate the tip of it in the mixture of sal ammoniac and solder, until it has been covered with the melted solder and is as bright as silver.

When capping the full cans, arrange them in rows upon the table while the capping and tipping irons are in the fire heating. Take a handful of solder-hemmed caps and place the caps on all cans ready to be capped. Place a finger on the venthole, hold the cap in place, and run the brush containing a small amount of flux around the solder-hemmed cap, evenly, with one stroke of the hand. Be careful not to get the flux inside of the can. Do this with all cans ready to be capped. Then take the capping iron from the fire, and insert the upright steel in the center. Hold the capping iron above the cap until the center rod touches the cap and holds it in place. Then bring the cap down in contact with all four points of the solder-hemmed cap, and rotate back and forth about three strokes. Do not bear down on the capping iron. A forward and backward rotation, if properly applied, will solder the cap in place perfectly. Remove the capping iron and inspect the joint. If any pinholes are found, recap or repair with the tipping copper. It may be necessary to use a piece of wire solder

or a waste solder rim from a cap to add more solder to the broken places or pinholes of a cap.

Tipping a Tin Can. With the flux jar and brush conveniently at hand, dip the brush in the flux and strike the venthole a side stroke lightly with the brush saturated with flux. Place the point of the wire solder over the venthole. Place upon this the point of the hot, bright, tipping copper. Press down with a rotary motion and remove quickly. (If a waste solder-hemmed cap rim is available, this may be used instead of the wire solder.)

With a little practice a smooth, perfect joint is easily made.

SUGGESTIONS ON ORDERING TIN CANS

In buying hole-and-cap cans it always is necessary to state whether you desire plain tin or enameled (lacquered) cans. In buying caps always ask for solder-hemmed caps and give the diameter of the can opening. For whole fruits and vegetables, cans with $2\frac{7}{16}$-inch or even larger openings are preferable. Since the size of the can opening varies, and ordinarily it will not be advisable to have more than one capping iron, it is recommended that the larger size ($2\frac{7}{16}$-inch) capping iron be purchased.

U. S. DEPARTMENT OF AGRICULTURE
FARMERS' BULLETIN NO. 841

DRYING FRUITS AND VEGETABLES IN THE HOME

With Recipes for Cooking

INTRODUCTION

One of the most prominent features of the food conservation program of European countries has been the universal drying of fruits and vegetables. The surplus vegetables in the city markets were forced by the Governments into large municipal drying plants. Community driers were established in the trucking regions, and even itinerant drying machines were sent from farm to farm, drying the vegetables which otherwise would have gone to waste. In addition, large quantities of dried vegetables from Canada and this country were shipped to France during the last two years, and there is a possibility that dried fruits and vegetables may continue to be shipped abroad in considerable quantities, to supplement the concentrated food diet of the men in the trenches.

The drying of vegetables may seem strange to the present generation, but to our grandmothers it was no novelty. Many housewives even to-day prefer dried

sweet corn to the product canned by the old method, and say also that dried pumpkin and squash are excellent for pie making. Snap beans often are strung on threads and dried above the stove. Cherries and raspberries still are dried on bits of bark for use instead of raisins. In fact, many of the everyday foodstuffs already are dried at some stage of their preparation for market. The common dried fruits, such as prunes, raisins, figs, dates, and apples, are staples in the world's markets, while beans and other legumes, tea, coffee, cocoa, and various manufactured foods, like starch, tapioca, macaroni, etc., are dried either in the sun and wind or in specially constructed driers.

Even though the drying of fruits and vegetables as practiced a few decades ago on many farms has become practically a "lost art," the present food situation doubtless will cause a marked stimulation of drying as a means of conserving the food supply. This country is producing large quantities of perishable foods this year, which should be saved for storage, canned, or properly dried. Drying is not a panacea for the entire waste evil, nor should it take the place of storing or canning to any considerable extent where proper storage facilities are available or tin cans or glass jars can be obtained readily and at a low cost.

The advantages of drying vegetables are not so apparent for the farm home as they are for the town or city household, which has no root cellar or other place in which to store fresh vegetables. For the farmer's wife the new methods of canning probably will be better than sun drying, which requires a somewhat longer time. But shorter methods of drying are available, and the dried product holds an advantage in that usually it requires fewer jars, cans, or other containers

than do canned fruits or vegetables; also dried material can be stored in receptacles which can not be used for canning. Then, too, canned fruit and vegetables freeze and can not be shipped as conveniently in winter. Dried vegetables can be compacted and shipped with a minimum of risk.

To the housewife in the town the drying of vegetables and fruits presents special advantages. During the season when the market is oversupplied locally and prices are low she can lay in a stock, dry it, and put it away for a winter's emergency without its taking up much of the needed small storage space in her home. If she is accustomed to canning her fruit and vegetables and finds she can not secure jars or tin cans, she can easily resort to drying.

With simple and inexpensive facilities, all housewives can save quantities of food which are too small conveniently to can. A few sweet potatoes or apples or peas or even a single turnip can be dried and saved. Even when very small quantities are dried at a time, a quantity sufficient for a meal will soon be secured. Small lots of several dried vegetables, such as cabbage, carrots, turnips, potatoes, and onions, can be combined to advantage for soups and stews.

This bulletin records some of the points brought out in a preliminary investigation of the home drying of fruits and vegetables which has been conducted by the department.

Principles and Methods of Drying

Three main ways of drying are applicable in the home manufacture of dried fruits and vegetables, namely, sun drying, drying by artificial heat, and dry-

ing by air blast. These, of course, may be combined. In general, most fruits or vegetables, to be dried quickly, must first be shredded or cut into slices, because many are too large to dry quickly or are covered with a skin, the purpose of which is to prevent drying out. When freshly cut fruits or vegetables are to be dried by means of artificial heat, they should be exposed first to gentle heat and later to the higher temperatures. If the air applied at the outset is of too high a temperature, the cut surfaces of the sliced fruits or vegetables become hard, or scorched, covering the juicy interior so that it will not dry out. Generally it is not desirable that the air temperature in drying should go above 140° to 150° F., and it is better to keep it well below this point. Insects and insect eggs are killed by exposure to heat of this temperature.

It is important to know the degree of heat in the drier, and this can not be determined very accurately except by using a thermometer. Inexpensive oven thermometers can be found on the market, or an ordinary chemical thermometer can be suspended in the drier. If a thermometer is not used, the greatest care should be given to the regulation of the heat. The temperature in the drier rises rather quickly and the product may scorch unless close attention is given. The reason sun drying is popularly believed to give fruits and vegetables a sweeter flavor lies probably in the fact that in the sun they never are scorched, whereas in the oven or over a stove, scorching is likely to occur unless careful attention is given them.

Drying of certain products can be completed in some driers within 2 or 3 hours. The time required for drying vegetables varies. However, it can be determined easily by a little experience on the part of the person

doing the drying. The material should be stirred or turned several times during the drying in order to secure a uniform product.

The ability to judge accurately as to when fruit has reached the proper condition for removal from drier can be gained only by experience. When sufficiently dried it should be so dry that it is impossible to press water out of the freshly cut ends of the pieces, and will not show any of the natural grain of the fruit on being broken, and yet not so dry that it will snap or crackle. It should be leathery and pliable.

When freshly cut fruits or vegetables are spread out they immediately begin to evaporate moisture into the air around them, and if in a closed box will very soon saturate the air with moisture. This will slow down the rate of drying and lead to the formation of molds. If a current of dry air is blown over them continually, the water in them will evaporate steadily until they are dry and crisp. Certain products, especially raspberries, should not be dried hard, because if too much moisture is removed from them they will not resume their original form when soaked in water. On the other hand, the material must be dried sufficiently or it will not keep, but will mold. Too great stress can not be laid upon this point. This does not mean that the product must be baked or scorched, but simply that it must be dried uniformly through and through.

It will be found advisable also to "condition" practically all dried vegetables and fruits. This is best done in a small way by placing the material in boxes and pouring it from one box into another once a day for 3 or 4 days, so as to mix it thoroughly and give to the whole mass an even degree of moisture. If the

material is found to be too moist, it should be returned to the drying trays for a short drying.

Preparation of Food for the Drier

In large factories the vegetables are put through special shredders and slicers not adapted for home use, but convenient and inexpensive machines which can be used to great advantage are on the market. The meat grinder with its special disks can be used in certain cases; the common kraut slicer will cut into slices large vegetables such as potatoes and cabbage; and the rotary hand slicer is adapted for use on a very wide range of material. A large sharp kitchen knife may be used when a handier cutting device is not available. Care should be taken that the material is sliced thin enough but not too thin. From an eighth to a quarter of an inch is a fair thickness for most of the common vegetables to be sliced and dried. Very small slices or strips dry more quickly because they expose a greater surface to the air than do larger cut pieces. But if cut too fine they are more difficult to handle in drying, appear to lose somewhat in flavor, and can not be used so advantageously to make dishes like those prepared from the fresh foods.

The slicing machines are not suitable for children's use, for they will cut fingers as mercilessly as they do vegetables and fruits, and even adults should exercise great caution in their use in the home.

Cleanliness is as necessary in the preparation of vegetables and fruits for drying as in their preparation for canning, perhaps even more so. To secure a fine quality of dried products much depends upon having the vegetables absolutely fresh, young, tender, and perfectly clean. If steel knives are used in paring and

cutting, have them clean and bright so as not to discolor the vegetable. The earthy smell and flavor will cling to root crops if they are not washed thoroughly before slicing, and one decayed root may flavor several kettles of soup if the slices from it are scattered through a whole batch of dried material. High-grade dried "root" vegetables can only be made from peeled roots.

In the preparation of large quantities of potatoes a potato peeler may be utilized. The potatoes are thrown by centrifugal force against a rough surface which, under streams of water provided by the perforated tin container above, nicks off the outer skin and leaves only the eyes to be dug out.

Blanching of vegetables is considered desirable by some housekeepers, although it is not strictly essential to successful drying. It is claimed that the blanch gives a more thorough cleaning, removes the strong odor and flavor from certain kinds of vegetables, and softens and loosens the fiber. This allows the moisture in the vegetable to evaporate more quickly and uniformly. It also quickly coagulates the albuminous matter in the vegetables, which helps to hold in the natural flavors. Blanching consists of plunging the vegetable into boiling water for a short time. Use a wire basket or cheese-cloth bag for this. After blanching the required number of minutes, drain well and remove surface moisture from vegetables by placing between two towels or by exposing to the sun and air for a short time.

Apparatus for Drying

The drying of fruits and vegetables in the sun is a simple process if they have been prepared properly.

In its simplest form such drying consists in spreading the freshly prepared slices or pieces on sheets of paper, or, if there is danger of the product's sticking, spreading on old pieces of muslin held down with stones. Bright, hot sunny days are chosen for this work, and a close watch is kept to see that no rain or dew wets the product. If flies and other insects are abundant, a mosquito bar is thrown over the product. Once or twice a day the slices are stirred or turned over with the hand, and the thin ones which dry first are taken out. Sun drying has much to recommend it, since it requires no expenditure of fuel and there is little danger of the product becoming overheated. Dust, however, gathers on the product, and, unless it is protected carefully, flies, and especially certain insects which habitually attack dried fruits, will lay their eggs upon it. These eggs later will hatch out, and the worms, or larvæ, will riddle the dried fruits or vegetables, rendering them unfit for the table.

Fruits and vegetables, when dried in the sun, generally are spread on large trays of uniform size, so constructed that they can be stacked one on top of the other and protected from rain by means of a cover made of oilcloth, canvas, or roofing paper.

A very cheap tray can be made of strips of lumber $\frac{3}{4}$ inch thick and 2 inches wide, which form the sides and ends, and lath which is nailed on to form the bottom. Spaces $\frac{1}{8}$ inch wide should be left between the laths for ventilation, and the trays can be raised off the ground by placing them on poles or an improvised trestle. As laths are 4 feet long, these lath trays are most economical of material when made 4 feet in length.

Better but more expensive trays can be made by

substituting galvanized-wire screen, $\frac{1}{8}$ or $\frac{1}{4}$ inch mesh, for the laths, in which case the most economical size would depend upon the width of the wire screen obtainable.

A cheap and very satisfactory drier for use over the kitchen stove can be made by any handy boy or carpenter from a small amount of small-mesh galvanized-wire netting and a number of laths or strips of wood about $\frac{1}{2}$ inch thick and 2 inches wide. The screen may be tacked directly on the framework to make the drying shelves, or the framework can be made to support separate trays. By using two laths nailed together, the framework can be stiffened, and larger trays made if desirable. This form or any of the lighter makes of driers can be suspended from the ceiling over the kitchen range or over the oil, gasoline, or gas stove, and it will utilize the hot air which rises during the cooking hour. It can be raised out of the way or swung to one side by a crane made of lath, when the stove is required for cooking purposes, and lowered or swung back to utilize the heat which otherwise would be wasted, when the top of the stove is not in use.

Another homemade cookstove drier that can be used on a wood or coal range or a kerosene stove can be made easily and cheaply. Dimensions: Base 24 by 16 inches; height 36 inches. A base 6 inches high is made of galvanized sheet iron. This base slightly flares toward the bottom and has two small openings for ventilation in each of the four sides. On the base rests a box-like frame made of 1 or $1\frac{1}{2}$ inch strips of wood. The two sides are braced with $1\frac{1}{4}$-inch strips which serve as cleats on which the trays in the drier rest. These are placed at intervals of 3 inches. The

frame is covered with tin or galvanized sheet iron which is tacked to the wooden strips of the frame. Thin strips of wood may be used instead of tin or sheet iron. The door is fitted on small hinges and fastened with a thumb latch. It opens wide so that the trays can be removed easily. The bottom of the drier is made of a piece of perforated galvanized sheet iron. Two inches above the bottom, is placed a solid sheet of galvanized iron which is 3 inches less in length and width than the bottom. This sheet rests on two wires fastened to the sides of the drier. This prevents the direct heat from coming in contact with the product and serves as a radiator to spread the heat more evenly.

The first tray is placed 3 inches above the radiator. The trays rest on the cleats 3 inches apart. A drier of the given dimensions will hold 8 trays. The frame of the tray is made of 1-inch strips on which is tacked galvanized screen wire, which forms the bottom of the tray. The tray is 21 by 15 inches, making it 3 inches less in depth than the drier. The lowest tray when placed in the drier is pushed to the back, leaving the 3-inch space in front. The next tray is placed even with the front, leaving a 3-inch space in the back. The other trays alternate in the same way. This permits the current of heated air to pass around and over the trays. A ventilator opening, about 2 inches wide and 6 inches long, is left in the top of the drier, through which the moist air may pass away.

This principle of construction is followed so that currents of heated air will pass over the product as well as up through it, gathering the moisture and passing away. The movement of the current of air induces a more rapid and uniform drying. The upper trays can be shifted to the lower part of the drier, and the

lower trays to the upper part as drying proceeds, so as to dry the products uniformly throughout.

Still another home drier is the cookstove oven. Bits of food, left overs, especially sweet corn, can be dried on plates in a very slow oven or on the back of the cookstove and saved for winter use. If the oven is very warm the door should be left ajar and the temperature of the oven often noted. Trays for use in the oven can be made from a convenient-sized galvanized wire screen by bending up the edges 1 or 2 inches.

Cookstove driers on the market are of two types. One type consists of a series of trays upon which the material to be dried is spread. These trays are placed in a framework one above the other, forming a compartment through which the heated air rises, carrying off the moisture. The second type consists of a shallow flat metal box filled with water and designed so that one end can rest on the back of the stove and the other on a leg reaching to the floor. It also may be supported over a lamp.

The use of an electric fan in facilitating drying can be highly recommended. This is feasible for those who already own a fan. It has been found that many sliced vegetables and fruits placed in long trays 3 by 1 foot and stacked in two tiers, end to end, before an electric fan, can be dried to the requisite dryness within 24 hours. Some require much less time. For instance, sliced string beans and shredded sweet potatoes will dry, before a fan running at a moderate speed, within a few hours. In many cities the electric fan will cost not more than one-fourth of a cent an hour to run. The fan should be placed close to the stack of trays, and they should not be filled so full that

the air can not pass freely through them. The fan method has a marked advantage in that the product keeps cool owing to evaporation while it is being dried, thus tending to retain the color and eliminate spoilage.

Directions for Drying

Many of the products for which directions are given here may be dried either with or without preliminary blanching. In such cases both methods are described. Alternative methods are designated by letters.

Sweet Corn

Only very young and tender corn should be used for drying, and it should be prepared at once after gathering.

(*a*) Cook in boiling water 2 to 5 minutes, long enough to set the milk. Cut the kernels from the cob with a sharp knife, taking care not to cut off pieces of the cob. Spread thinly on trays, and place in position to dry. Stir occasionally until dry.

(*b*) Boil or steam on the cob 8 to 10 minutes, to set the milk. To improve flavor, a teaspoon of salt to a gallon of water may be used. Drain well and cut corn from cob, using a very sharp and flexible knife. Cut grains fine, only half way down to the cob, and scrape out the remainder of grain, bring careful not to scrape off any of the chaff next to the cob. Dry from 3 to 4 hours at 110° to 145° F. When field corn is used, good, plump roasting-ear stage is the proper degree of ripeness. A pound of dried corn per dozen ears is an average yield.

(*c*) The corn may be dried in the sun. Dry in oven 10 to 15 minutes, and finish drying in the sun.

Sun drying, of course, is not satisfactory in moist weather.

Pack in cartons or boxes for a few days to "condition," as described on page 300.

String or Snap Beans

All varieties of string beans can be dried, but only beans in ideal condition for table use should be selected for this purpose.

(*a*) Wash; remove stem, tip and "strings." Cut or break the beans into pieces $\frac{1}{2}$ to 1 inch long, and place on trays, and dry. They also can be run through the slicer and then dried quickly.

(*b*) Prepare as directed above, but instead of cutting the beans, thread them on coarse, strong thread, making long "necklaces" of them, and hang them above the stove or out of doors until dry. An old-fashioned recipe calls for boiling the pods until nearly cooked through, before drying.

(*c*) Wash and string beans carefully. The very young and tender beans can be dried whole. Those that are full grown should be cut in $\frac{1}{4}$ to 1 inch lengths with vegetable slicer or a sharp knife. It is better to cut beans than to snap them. They are then put in a bag of cheese-cloth or in a wire basket and blanched in boiling water for 6 to 10 minutes, depending on the maturity of the bean. One-half teaspoon of soda may be added to each gallon of boiling water to help set the green color in the beans. Remove surface moisture by placing between two towels or by exposing to the sun and air for a short time. Dry young string beans 2 hours, more matured beans 3 hours. Begin drying at temperature of 110° F. and raise temperature gradually to 145° F.

Wax beans are dried in the same manner as the green string beans.

"Condition" as described on page 300.

Lima Beans

Lima beans can be shelled from the pod and dried. If gathered before maturity, when young and tender, wash and blanch from 5 to 10 minutes. Length of time for blanching depends upon size and maturity of beans. Remove surface moisture and dry from 3 to $3\frac{1}{2}$ hours at same temperature as string beans.

Dry Shelled Beans (Important in the South)

Beans of different kinds, after maturing and drying on the vines, can be treated as follows: Shell, wash, spread in thin layers on the trays of the drier and heat 10 minutes, beginning at 160° F. and gradually raising the temperature to 180° F. This high temperature is for the purpose of destroying all insect eggs that may be on the beans. Cowpeas or any field pea can be treated in the same way. Cool and store carefully. It might be added that the heating of the bean or pea destroys its vitality. When so treated it can not be used for seed.

Okra

(*a*) Small, tender pods sometimes are strung on a stout thread and hung over the stove to dry. If dried in that manner, heat in oven before storing on trays.

(*b*) Wash, blanch 3 minutes in boiling soda water, and dry 2 to 3 hours at 110° to 140° F. Use $\frac{1}{2}$ teaspoon soda to a gallon of water. Dry young and small tender pods whole. Older pods should be cut in $\frac{1}{4}$-inch slices.

Peppers

(*a*) Peppers may be dried by splitting on one side, removing seed, drying in the air, and finishing the drying in the drier at 140° F. A more satisfactory method is to place peppers in biscuit pan in oven, and heat until skin blisters, or to steam peppers until skin softens, peel, split in half, take out seed, and dry at 110° to 140° F. In drying thick-fleshed peppers like the pimento, do not increase heat too quickly, but dry slowly and evenly.

(*b*) Small varieties of red peppers may be spread in the sun until wilted and the drying finished in the drier, or they may be dried entirely in the sun.

(*c*) Peppers often are dried whole. If they are large they can be strung on stout thread; if small, the whole plant can be hung up to dry.

Peas

(*a*) Shell and spread on trays and dry.

(*b*) Shell full-grown peas with nonedible pod, blanch the peas from 3 to 5 minutes, remove surplus moisture, spread in single layer on trays, and dry from 3 to 3½ hours. Begin drying at 110° F., raising temperature very slowly in about 1½ hours to 145° F. Continue drying 1½ or 2 hours at 145° F.

(*c*) Shell full-grown peas, passing through a meat grinder, spread on trays, and dry. Whole peas take longer to dry, but when cooked they resemble fresh peas. The ground peas dry more quickly but make a product which can be used successfully only in the preparation of soup or purée.

(*d*) When drying the very young and tender sugar peas, use the pod also. Wash and cut in ¼-inch pieces.

Blanch in boiling water 6 minutes. Remove surplus moisture and dry the same length of time and at the same temperature as string beans. It is not necessary to use soda when blanching peas.

Pack away and " condition " as described on page 300.

Garden Beets, Onions, Leeks, Carrots, Turnips, Parsnips, Cabbage

Beets: (*a*) Select young, quickly grown, tender beets. Wash, peel, slice about $\frac{1}{8}$ inch thick, and dry.

(*b*) Boil the whole beets, unskinned, until a little more than three-fourths done. Dip in cold water, peel, and slice into $\frac{1}{8}$ or $\frac{1}{4}$ inch slices. Dry $2\frac{1}{2}$ to 3 hours at 110° to 150° F.

Turnips: Turnips should be treated in the same way as beets.

Carrots: Varieties having a large, woody core should be avoided.

(*a*) Wash, peel, slice lengthwise into pieces about $\frac{1}{8}$ inch thick, and dry.

(*b*) Clean, scrape, or pare, and slice into $\frac{1}{8}$-inch slices. Blanch 6 minutes, remove surface moisture, and dry $2\frac{1}{2}$ to 3 hours. Begin drying at 110° F. and raise temperature gradually to 150° F.

Parsnips, kohl-rabi, celeriac, and salsify are dried by the same methods.

Onions: (*a*) Select well-matured onions and remove the outside papery covering. Cut off tops and roots. Slice into $\frac{1}{8}$-inch pieces and dry quickly. Store in a light-proof container to avoid discoloration.

(*b*) Wash, peel, and slice onions into $\frac{1}{8}$ to $\frac{1}{4}$-inch slices. To avoid any unpleasantness, peel and slice while holding under water. Blanch in boiling water 5 minutes. Remove surface moisture and dry $2\frac{1}{2}$ to

3 hours, beginning at 110° F. and raising temperature gradually to 140° F.

Leeks are handled in a similar manner, cut into ¼-inch strips and dried.

Cabbage: (*a*) Select well-developed heads of cabbage and remove all loose outside leaves. Split the cabbage, remove the hard, woody core, slice the remainder of the head with a kraut cutter or slicer, and dry.

(*b*) Shred or cut into strips a few inches long. Blanch 10 minutes, drain, remove surface moisture, and dry 3 hours at 110° to 145° F.

All these products should be "conditioned" as described on page 300.

Spinach and Parsley

Spinach that is in prime condition for greens should be prepared by careful washing and by removing the leaves from the roots. Spread the leaves on trays to dry thoroughly. Slicing will greatly facilitate drying.

Parsley should be treated in the same way as spinach.

Beet Tops, Swiss Chard, Celery, and Rhubarb

Beet tops: Tops of young beets in suitable condition for greens should be selected and washed carefully. Both the leafstalk and the blade should be cut into sections about ¼ inch long, spread on screens, and dried.

Swiss chard and celery should be prepared in the same way as beet tops. Celery also may be prepared in the same way as pumpkins and summer squash.

Rhubarb: Choose young and succulent growth. Prepare as for stewing, by skinning the leafstalks and cutting into pieces about ¼ inch to ½ inch in length. Do not use the blade of the leaf.

All these products should be "conditioned" as described on page 300.

Irish Potatoes

Select good, sound, well-matured potatoes.

(*a*) Wash and boil or steam until nearly done. Peel and pass through a meat grinder or a potato ricer. Collect the shreds in layers on a tray and dry until brittle. If toasted slightly in an oven when dry, the flavor is improved somewhat.

(*b*) Boil or steam until nearly done, peel as above, cut into $\frac{1}{4}$-inch slices, spread on trays, and dry until brittle.

Peeling may be omitted, but the product will be very much inferior in flavor.

Sweet Potatoes

Select sound, mature roots.

(*a*) Wash, boil until nearly done, peel, and run through the meat chopper. Spread on trays and dry until brittle.

(*b*) Treat as above, but slice instead of running through the meat chopper.

(*c*) Wash, peel, slice, spread on trays, and dry. A somewhat brighter product will result if the sliced potato is dipped in salt water just before drying.

Cauliflower

Clean, divide in small bunches, blanch 6 minutes, and dry 2 to 3 hours at 110° to 145° F. Cauliflower will turn very dark when drying, but will regain part of the color in soaking and cooking. Dried cauliflower is especially good in soups and omelets.

Brussels sprouts may be handled in a similar way, but add a pinch of soda to the blanching water.

Pumpkins and Squash

(*a*) Select sound, well-grown specimens. Cut into strips; peel these; remove all seeds and the soft part surrounding them. Cut strips into smaller bits not over $\frac{1}{4}$ inch thick and 2 inches long, and dry.

(*b*) Pare and cut into about $\frac{1}{2}$-inch strips and blanch 3 minutes. Remove surface moisture and dry slowly from 3 to 4 hours, raising temperature from 110° to 140° F.

Pack and " condition " as described on page 300.

Soup Mixtures

Each vegetable used in the soup mixture is prepared and dried separately. They are put together in proportions desired, the preferred flavoring vegetables predominating. A combination of several vegetables makes the most desirable soup mixture. Those most often used are carrots, cabbage, onions, celery, potatoes, and okra.

Herbs

Celery tops, parsley, mint, sage, and herbs of all kinds need not be blanched, but should be washed well and dried in the sun or in the drier. These are good for flavoring soups, purées, gravies, omelets, etc.

Apples, Pears, and Quinces

Early varieties and sweet apples are not well adapted to drying. Winter apples should be used for this purpose.

(*a*) Peel, core, trim, and slice $\frac{1}{4}$ inch thick. Dip in weak salt solution containing 8 teaspoons of salt to 1 gallon of water. Spread on trays and dry. It is only necessary to dry apples long enough for them to become tough and somewhat leathery.

(*b*) Pare, core, and cut into eighths, or core and slice in rings, using fruit or vegetable slicer. As apples discolor quickly, do not let them stand long before drying. To prevent discoloration, as the fruit is prepared it may be dipped for 1 minute in a cold salt bath, using 1 ounce of salt to 1 gallon of water. Remove surplus moisture and dry at 110° to 150° F., raising temperature gradually. Dry from 4 to 6 hours, and longer if necessary.

Pears are dried in the same way as apples. They may be steamed 10 minutes before drying.

Quinces are treated in the same was as pears.

Pack and " condition " as described on page 300.

Raspberries

(*a*) Sort out imperfect berries, spread the selected berries on trays, and dry. Do not dry so long that they become hard enough to rattle. The drying should be stopped as soon as the berries fail to stain the hand when pressed.

(*b*) Pick leaves and stems from fruits and spread fruits on trays. Handle carefully and do not bruise. Spread in thin layer, and dry slowly. Raise temperature gradually from 110° to 125° F. in about 2 hours. Do not raise temperature higher than 130° F. until a considerable portion of the moisture has evaporated, as otherwise expansion will occur and juice will be lost by dripping. This is accompanied by loss of flavor and color. Finish drying berries at 140° F. for 2 to 3 hours. It is necessary to dry berries from 4 to 5 hours.

Blackberries, dewberries, and huckleberries can be dried in the same way as raspberries.

Pack and " condition " as described on page 300.

Peaches

Peaches usually are dried unpeeled, but they will be better if peeled before drying.

(*a*) Remove the stones, cut the fruit into halves, or preferably into smaller pieces, and spread on trays to dry.

(*b*) Cut in halves, pit, lay in trays pit side up, and dry at same temperature and for same length of time as applies.

Peaches should be packed carefully and "conditioned" as described on page 300.

Plums and Apricots

Plums: (*a*) Plums are not peeled, but the pits are removed, the fruit being cut into halves and dried in the same way as peaches.

(*b*) Select medium-ripe plums, cover with boiling water, cover the vessel and let stand 20 minutes. Small, thin-fleshed varieties are not suitable for drying. Drain, remove surface moisture, and dry from 4 to 6 hours, gradually raising temperature from 110° to 150° F.

Apricots are handled in the same way as plums.

Pack and "condition" as described on page 300.

Cherries

(*a*) Remove stems of cherries and, if the fruit is large, the pits also. Spread out on trays to dry. Small, black cherries can be dried when containing the stones.

(*b*) Wash, remove surface moisture, and spread cherries, unseeded, in thin layer on trays. If cherries are seeded there will be a loss of juice. Dry from 2

to 4 hours at 110° to 150° F. Raise temperature gradually.

Pack and " condition " as described on page 300.

Precautions against Insects

Two kinds of moths stand out prominently among insects that attack dried fruits and vegetables. They are much more likely to get into the fruit during the process of drying than to find their way through boxes into the products stored inside them. This applies particularly to drying in the sun.

A small moth called the Indian-meal moth is the most destructive insect that attacks dried fruits and vegetables. It is about $\frac{3}{8}$ inch long and has a cloaked appearance, one-third gray and the rest copper brown. The fig moth is about the same size, but is a dark neutral gray. A minute, flattened, chocolate-brown beetle usually accompanies these moths and does considerable damage. Both of the moths deposit their eggs on fruit when it is on the drying racks—generally at dusk or after dark, as they are not fond of daylight. It takes from 3 to 10 days for the eggs to hatch into whitish or pinkish grub-like caterpillars and from 5 to 10 weeks from the laying of the eggs till the appearance of the moth to lay another lot of eggs; and since a number of " broods " or generations are produced yearly, if a few of these moth eggs are stored away on dried fruits or vegetables, hundreds of caterpillars are produced and many pounds of valuable material may be destroyed during the course of the winter if it is stored in a warm room. Warm dark bins or dried fruit in sacks offer especially favorable places for their development. It is evident that the larger the

amount of material in a package, the greater the chance of a few eggs doing a great deal of damage. Small cartons or containers have the advantage of confining the injury from these moths to small quantities of material, for, if the containers are closed tightly, they can not easily escape from them and infest other packages, which may not have been infested previously.

In sun drying, if the drying racks are screened early in the evening and at night, the cheese-cloth or fly screen battened down, and the dried fruit and vegetables stored in tight paper sacks in a cool place, no danger ordinarily need be feared from these insects. As an additional precaution, the dried product, before being stored, may be heated to 140° F. long enough to allow the heat to penetrate throughout. This will sterilize it if already infested.

In drying by artificial heat, the process itself ordinarily will sterilize the product. But after drying it should be stored promptly, to prevent infestation.

Directions for Packing and Storing

Although not necessary, tin cans or glass jars make good receptacles for storage of dried fruits or vegetables. Pasteboard boxes with tight covers, stout paper bags, and patented paraffin paper cartons also afford ample protection for dried products when protected from insects and rodents. The dried fruit or vegetables must be protected from the outside moisture and will keep best in a cool, dry, well-ventilated place. These conditions, however, are difficult to obtain in the more humid regions, and there moisture-tight containers should be used.

If a small amount of dried product is put in each receptacle, just encugh for one or two meals, it will not

be necessary to open a container the contents of which can not be consumed in a short time. The use of the small container also makes it more difficult for insects to spoil large quantities of the dried fruits or vegetables. If a paper bag is used, the upper part should be twisted into a neck, bent over, and tied tightly with a string. If a further precaution against spoilage is necessary the bag can be coated with paraffin by painting it with a brush which has been dipped into melted paraffin. Another precaution may be taken by placing the small bags in a tin container with a tightly fitting cover, such as an ordinary lard can or pail. All bags should bear a label indicating what they contain.

If fruits or vegetables are packed in tight containers immediately upon being dried thoroughly, they will remain just as brittle as they were when taken from the drier. If, however, they are not dried thoroughly, they will "sweat" and soon mold. To prevent this the material should be examined within 24 hours after packing, and if it appears moist it must be dried further.

Recipes for Cooking Dried Fruits and Vegetables

It must be remembered that the water which has been dried out of the fruits or vegetables must be restored to them before cooking and that this process requires time. In general, the longer it takes to dry, the longer should the dried products soak. Because the kind of vegetable (old and tough or young and tender), the size of the pieces (large or small), and the amount of moisture which the dried product contains affect the length of time the vegetable should soak, the housekeeper must use her best judgment in selecting the method of preparation best suited to her own products.

Once soaked, dried vegetables and fruits can be cooked in almost any of the ways in which fresh ones can be cooked, recipes for which are given below. These are in use by commercial concerns.

SNAP BEANS

Soak overnight or 8 to 12 hours, using 10 pints of water to 1 pound of beans, or 3 times as much water as beans. Boil 3 hours in the same water, with a slice of bacon; drain off water and add salt, pepper, and butter. Cream sauce may be used. Four ounces of dried beans will serve 10 people.

BEETS

Dried, sliced beets, if soaked too long, lose their red color and good flavor. Soaking for 2 hours (2 parts water to 1 part beets) should be sufficient. They should then be cooked in the same water for about 1½ hours. If they are cooled in the same water in which they are cooked, it is believed that the color is improved. Cured by process B.

Dried beets, after soaking, may be cooked in various ways, the same as fresh beets.

Creamed Beets. Soak 1 cup of dried beet root in 2 cups of water from 6 to 8 hours. Cook until tender. Cool in the same water. Drain off water. Add 2 tablespoons of sugar, ¼ cup of vinegar, ¼ cup of water, tablespoon of butter, and a little salt; heat together to boiling point, thicken a little with flour and water well blended. Serve hot. Cured by process A.

Pickled Beets. Cook as above, add vinegar and spices and sweeten to taste. Dried beets may seem to lose color, but cooling in the water in which they were boiled will tend to restore the natural color.

Buttered Beets. Soak 2 cups of dried beets for two hours in 4 cups of cold water and cook until tender. Drain and add to the beets 2 tablespoons of butter, 1 teaspoon of salt, and ¼ teaspoon of pepper. Stir carefully in order to butter and season each slice of beet without breaking it. Serve hot.

CARROTS

Buttered Carrots. Very young carrots do not require soaking. They may be placed in cold water (about 3 cups of water to 1 cup of dried carrots) and cooked slowly for about 1¼ hours. If the carrots are old and cut in large pieces for drying, soaking 2 to 8 hours or even overnight may be necessary. Drain off water, add salt and pepper, and serve buttered or with drawn butter or cream sauce.

To use with boiled or roast meats, soak as above, boil in same water 10 minutes, and drop in with the meat.

Carrot Pudding. Soak ⅓ cup of dried carrots in 2½ cups of water 6 to 8 hours, or overnight. Add to the carrots 1 cup of raw potatoes, 1 cup of dried cherries, and ⅔ cup of suet, and chop up fine. Then add 1 cup of flour, 1 cup of sugar, ½ teaspoon salt, 1 teaspoon cinnamon, ½ teaspoon cloves, ½ teaspoon nutmeg, ½ teaspoon soda well mixed. Stir until thoroughly mixed. Steam 3 hours and serve hot with pudding sauce.

CELERY

Soak 8 to 12 hours, or overnight, using 12 pints of water to 1 pound of celery, or 3 parts of water to 1 part of celery. Boil in same water until tender and serve with cream and a tablespoon of butter.

CORN

Soak the corn for 2 to 4 hours in water, using 2 cups of water to 1 cup of corn. Some housekeepers prefer to soak it overnight, but if this is done the corn should be kept in a very cool place so that it does not sour. Cook the corn in the water in which it was soaked for an hour or more. Then season with butter, salt, and pepper, and if desired, a very little sugar also. Some housekeepers prefer to add milk to the water in which the corn is cooked or to use cream in place of butter for seasoning it.

ONIONS

Dried, thinly sliced onions may be cooked slowly without previous soaking, about 2 cups of water being needed for each cup of dried onion. If very dry, the onions are better if soaked from 2 to 6 hours and then cooked in the same water until

tender. After cooking, the onions may be used like any other onions, in a great variety of ways.

PARSNIPS

Soak the parsnips for 2 to 4 hours in water, using 2 cups of water to 1 cup parsnips, or 1 part parsnips to 2 parts water. Cook in the same water 30 minutes. Drain off water and brown in butter or other fat, or serve with cream sauce.

IRISH POTATOES

Soak 6 to 8 hours, or overnight, using 8 pints of water to 1 pound of potatoes, or 2 parts of water to 1 part of potatoes.

Fried Potatoes. Boil in the same water about 5 minutes. Drain and fry in the same way as fresh potatoes.

Mashed Potatoes. Boil in the same water 20 to 30 minutes. Drain and steam 5 to 10 minutes and then mash, adding salt, pepper, butter, and milk.

Dried Cooked Potatoes. If the potatoes were cooked before drying, it will not be necessary to soak them before cooking. Place the dried potato in a double boiler, add about 2 cups of milk to 1 cup of potato, cover, and steam until soft. Beat, season with salt, pepper, and butter, and serve like fresh mashed potatoes.

SWEET POTATOES

Dried raw sweet potatoes may be soaked and cooked like Irish potatoes (see above). In preparing dried cooked sweet potatoes for the table, water should be substituted for the milk used in steaming the Irish potatoes. Except for this, the same method can be followed.

RHUBARB

Stewed Rhubarb. Soak 6 to 8 hours, or overnight, using 12 pints of water to 1 pound of rhubarb, or 2 parts of water to 1 part of rhubarb. Cook in the same water until done and sweeten to taste.

Rhubarb Pie. Soak 1 cup of dried rhubarb in 2 cups of water 8 to 12 hours. Cook in the same water 30 minutes, then make into a pie as if it were fresh rhubarb

SPINACH

Dried spinach takes up water very readily and may be cooked slowly without previous soaking. If preferred, it can be soaked 2 to 6 hours, which will shorten the time required for cooking. A little salt pork added to the spinach improves the flavor, or it may be buttered when served.

SQUASH

Soak 8 to 12 hours, or overnight, using 10 pints of water to 1 pound of squash, or 3 parts of water to 1 part of squash.

Mashed Squash. Boil slowly in the same water 1 hour. Mash well and add salt, pepper, and butter.

Squash Pie. Soak 1 cup of dried squash 8 to 12 hours in 3 cups of water. Cook in the same water 1 hour and mash well. Mix thoroughly 1 egg well beaten, $\frac{3}{4}$ cup of sugar, $\frac{1}{2}$ teaspoon salt, and 1 tablespoon flour. Stir in $\frac{1}{2}$ teaspoon each of cinnamon, nutmeg, allspice, and ginger, a pinch of cloves, and $1\frac{1}{2}$ cups of milk. Add squash. Bake in a hot oven.

APPLES

Soak 6 to 8 hours, or overnight, using 6 pints of water to 1 pound of apples, or 3 parts of water to 1 part of apples. Two hours' soaking is sufficient for thinly sliced apples. Commercial apples are sulphured and do not discolor.

Apple Sauce. Cook about 30 minutes in the same water; then add 1 cup of sugar to 1 pound of fruit, $\frac{1}{2}$ teaspoonful of nutmeg or cinnamon, and mash.

Apple Pie. Cook in the same water about 5 minutes to make them tender, then drain off water and use in pie in the same way as fresh apples. One pound of dried apples will make eight large pies.

CHERRIES

Soak 6 to 8 hours, or overnight, using 4 pints of water to 1 pound of cherries, or 3 parts of water to 1 part of cherries.

Stewed Cherries. Cook slowly in the same water and sweeten to taste. One pound of dried cherries will serve 15 people.

Cherry Pie. Soak $\frac{1}{2}$ cup of dried cherries in 1 pint of water 6 to 8 hours. Heat in the same water 15 minutes. Drain

off the juice and use the cherries in the pie in the same way as fresh cherries. Add a little sugar to the juice drained off, boil down to a sirup, and pour over the pie hot as it is served.

PRUNES

Soak 6 to 8 hours, or overnight, using 2 pints of water to 1 pound of prunes, or 2 parts of water to 1 part of prunes.

Stewed Prunes. Cook slowly in the same water and sweeten to taste.

Spiced Prunes. Drain off water and add to it the following: For every 2 pounds of soaked up prunes, 1 pound of sugar, ¼ pint of vinegar, 1 teaspoonful cinnamon, 1 teaspoonful allspice and cloves. Put spices in a cloth. Boil the above 15 or 20 minutes until sirupy, then add prunes, and cook slowly about 30 minutes.

RASPBERRIES

Soak 4 to 5 hours, using 6 pints of water to 1 pound of raspberries, or 1½ parts of water to 1 part of raspberries. Cook in the same water 20 minutes and sweeten to taste. Use in the same way as fresh raspberries.

OKRA

Dried okra should be soaked until soft and used in the same way as fresh okra in the preparation of soups and stews.

CABBAGE

Creamed: Put heaping cupful in 7 cups of *cold fresh* water and bring *very slowly to a boil,* and boil steadily for 30 minutes. Do not cover kettle during cooking. Add ½ teaspoon salt. *Drain well.* Melt 2 tablespoons butter and, when it is bubbling hot, add 1 heaping tablespoon flour, 1 teaspoon salt, ¼ teaspoon pepper. Stir well but do not brown. Then add 1 cup milk slowly and stir until smooth and thick. Let come to a boil, then add the well-drained cabbage and heat together until boiling. Serve at once.

With vinegar dressing: Follow above general directions for cooking cabbage. *Drain well.* Add ½ cup vinegar, 2 tablespoons butter, 1 teaspoon salt, ¼ teaspoon pepper. Return to fire and heat a few minutes. Serve smoking hot.

TURNIPS

With butter sauce: Put heaping cupful in 8 cups cold, fresh water and bring *very slowly to a boil,* and boil steadily for 20 minutes. Add $\frac{1}{2}$ teaspoon salt and boil 25 minutes longer. Do not cover kettle during cooking. *Drain well,* and add 2 tablespoons butter, 1 teaspoon salt, $\frac{1}{4}$ teaspoon pepper, return to fire and heat until butter is all absorbed and serve smoking hot.

In white sauce: Follow above general directions for cooking turnips and *drain well,* melt 2 tablespoons butter and, when it is bubbling hot, add 1 tablespoon flour, $\frac{1}{2}$ teaspoon salt, and $\frac{1}{8}$ teaspoon pepper. Stir well but do not brown, then add 1 cup milk slowly and stir until thickened. Let come to a boil; add the well-drained turnips and heat together until boiling.

U. S. DEPARTMENT OF AGRICULTURE
FARMERS' BULLETIN NO. 881

PRESERVATION OF VEGETABLES BY FERMENTATION AND SALTING

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INTRODUCTION

Methods of preserving vegetables by salting or fermenting them have been practiced for a long time, and vegetables so prepared are known to be wholesome food. Recent experiments by the Department of Agriculture have shown that a great many vegetables may be satisfactorily preserved by such methods, which deserve a wider use in the home than they have had in the past. One advantage that these methods possess is that they make use of containers which could not be used for canning. For example, old kegs, lard and butter tubs, stone crocks or jars, wide-mouthed

glass jars, and glass preserving jars without covers, if thoroughly cleaned, may be used for the storage of salted or fermented vegetables. Another advantage is that, with a given amount of labor, a great deal more material can be cared for by these methods than could be preserved in the same time if canning or drying alone were depended upon.

General Principles of the Methods

The methods of preservation considered in this bulletin group themselves naturally under three heads: (1) Fermentation with dry salting, (2) fermentation in brine, and (3) salting without fermentation.

When vegetables are either packed dry with 2 or 3 pounds of salt to every 100 pounds of material, as in the making of sauerkraut, or are covered with a brine containing 5 pounds of salt to every 12 gallons of water, as in the preparation of dill pickles, the sugars present in the vegetables are extracted from them and are fermented by the lactic-acid-forming bacteria which are present naturally in great numbers on the surface of the fresh material. After this action has gone on to to a certain point, enough of this lactic acid is formed to kill the bacteria and prevent any further change in the material, provided certain precautions are taken to prevent the growth of molds. The lactic acid permeates the fermented material and gives it a characteristic flavor not unlike that of a weak vinegar solution. This flavor is relished by many. The lactic acid has no harmful effect. It is the same acid which is present in sour milk and it is digested and utilized by the body as a source of energy.

If the vegetables are covered with a very strong

brine, or are packed with a fairly large amount of salt, lactic-acid fermentation and also the growth of other forms of bacteria and molds are prevented. This method of preservation is especially applicable to those vegetables which contain so little sugar that sufficient lactic acid can not be formed by bacterial action to insure preservation of the material.

In the well-known method of vinegar pickling, the acetic acid of the vinegar acts like the lactic acid produced by fermentation, as a preservative, preventing the growth of bacteria or molds. Sometimes brining precedes pickling in vinegar, and often the pickling is modified by the addition of sugar and spices, which add flavor, as well as help to preserve the fruit or vegetables. In some cases olive oil or some other table oil is added to the vinegar, as in the making of oil cucumber pickles.

Equipment Needed

A supply of clean wooden kegs or stone crocks is the first requisite. For home use, the smaller sizes are preferable as a rule, because the contents will then be used up more quickly and there will be less chance of molding from standing too long after the kegs or crocks are opened. Wooden kegs holding 5 or 10 gallons are a convenient size. New kegs are preferable, but old ones, such as beer or cider kegs, may be used if they are thoroughly washed and steamed to remove any undesirable odor or flavor which might be imparted to the foods packed in them. Wooden vessels of yellow or pitch pine are undesirable, since they are apt to give a disagreeable taste to the foods. Stone crocks or jars holding from 1 to 5 gallons are convenient. Stoneware is less likely to absorb flavors than wood,

and stone jars may be obtained in smaller sizes than wooden kegs. Wide-mouthed bottles or glass jars, which are not suitable for canning, may also be used for salting or fermenting small quantities of foods.

A supply of ordinary fine salt, which can be purchased in bulk for about 2 cents per pound, is most satisfactory for general use. Table salt will do very well, but is rather expensive if large quantities of vegetables are to be preserved. The rather coarse salt (known in the trade as "ground alum salt"), which is used in freezing ice cream, can be used. Rock salt should not be used because it is too coarse and is likely to contain impurities.

Clean white cloth (cheese-cloth or muslin) is necessary for covering the material after it is packed into the container. It will be found convenient to cut this into circular pieces about 6 inches larger in diameter than the stone crock or keg. Two or three thicknesses of cheese-cloth, or one thickness of muslin or heavier cloth, should be spread over the top of the vegetables.

Round pieces of board about 1 inch or more in thickness will be needed to put on top of the cheese-cloth. The boards should be a little smaller in diameter than the inside of the crock or the head of the keg or tub, so that they will slip in and out easily. The pieces may be sawed out at a lumber mill, or may be made at home by fastening together several boards with cleats and rounding them with a small saw and a carpenter's shave. Almost any wood may be used except yellow or pitch pine, which is likely to impart an undesirable flavor to the vegetables. For small containers, if preferred, heavy plates of suitable size can be used instead of boards.

One or more clean bricks or some clean stones may be used as weights to hold down the mass in the keg or crock.

Paraffin is needed to pour over the liquid in the containers (after fermentation has ceased) to prevent mold.

A pair of kitchen scales or steelyards and a quart or gallon liquid measure complete the necessary equipment.

Fermentation with Dry Salting

As has already been stated, fermentation with dry salting consists in packing the material with a small amount of salt. No water is added, for the salt extracts the water from the vegetables and forms the brine. The method, in general, is as follows:

Wash the vegetables, drain off the surplus water, and weigh them. For each 100 pounds of the vegetables weigh out 3 pounds of salt; for smaller quantities use the same proportion (3 per cent by weight) of salt. Cover the bottom of the keg, crock, or other container with a layer of the vegetables about 1 inch thick and sprinkle over this a little of the salt. Do not add too much of the salt to the first layers packed, but try to distribute it equally among the different layers so that the quantity which has been weighed out will be sufficient for the given quantity of vegetables packed. If a little of the salt is left over, it can be added to the top layer, but if more has to be added than has been weighed out, the finished product will taste too salty. Continue adding layers of the material sprinkled with salt until the container is about three-fourths full. Sprinkle the last of the salt on the top layer and spread over it one or two thick-

nesses of cheese-cloth, tucking them down at the sides. On the cloth place one of the round pieces of board, or a plate, as just described, and on this put a clean stone or one or two clean bricks. The size of the weight depends on the quantity of material being preserved. For a 5-gallon keg a weight of 10 pounds will be sufficient, but if a larger barrel is used, a heavier weight will be needed. The weight added should be sufficient to extract the juices, to form a brine, which will cover the top in about 24 hours, and sometimes it may be necessary to add more stones after the material has stood a while, if a brine does not form.

After it is packed, allow the container to stand in a moderately warm room to ferment. The salt and pressure of the weight soon extract water from the vegetables and form a brine, which soon covers the whole mass. The stone and board serve to keep the vegetables beneath the surface of the liquid. If the weight is not sufficient for this purpose, a larger stone or more bricks should be added. As the fermentation goes on, bubbles arise to the surface of the liquid. The rate of fermentation depends principally upon the temperature. In warm weather it requires only 8 to 10 days; in cool weather 2 to 4 weeks may be necessary. When bubbling stops, fermentation is complete. A good way to determine this is to tap the receptacle gently; if no bubbles arise, fermentation is finished.

The containers should then be placed in a cellar or other cool storeroom and the surface of the liquid treated to prevent the development of a scum of mold. If this is not done a thin film will appear on the surface of the brine soon after fermentation ceases, which will spread rapidly and develop into a heavy

folded membrane. This scum is a growth of micro-organisms which feed upon the acid formed by fermentation. If allowed to grow undisturbed, all the acid will eventually be destroyed and the fermented material will spoil. This scum must be prevented from forming if the product is to be kept for a considerable time. Exclusion of air from the surface of the brine will entirely prevent its formation. There are three feasible methods of accomplishing this.

The first method is to cover the surface with very hot, melted paraffin. If the paraffin is sufficiently hot to make the brine boil when poured upon it, a smooth, even layer will be formed before hardening, making a perfectly air-tight seal. Before adding paraffin the containers should be set where they will not be disturbed until ready for use, as any attempt to move them afterwards may break the seal and necessitate resealing. Paraffin has the advantage of ease in handling, and of being easily separated from the fermented vegetables when they are removed. Further, it can be used over again and thus the expense is small in the long run. If it becomes dirty it can be purified by heating very hot and straining through several thicknesses of cheese-cloth. One disadvantage in the use of paraffin is that the formation of gas below the layer will break the seal; therefore it should not be used until fermentation has ceased. If the paraffin breaks, it should be removed, remelted, and replaced.

The second method is to pack a barrel or keg full and then replace the head. Fill the barrel or keg as full as possible with the fresh material to be fermented and then add the round board and weights exactly as described heretofore. Let the barrel stand for 48 hours to allow part of the gas to escape. Then

remove the board and weight, and head the barrel or keg up tight. Bore a small hole (about $\frac{1}{2}$ inch) in the head and fill the barrel full with brine (made by dissolving $\frac{3}{4}$ cup salt in 1 gallon water) so that there is no air space. Allow the barrel to stand until the fermentation has stopped, adding more brine at intervals to keep the container full. When bubbling has stopped, plug the vent tight. If the barrel does not leak, fermented products put up in this manner will keep indefinitely.

The third method is to use an oil, like cottonseed oil, which floats on the surface and effectively prevents air from reaching the brine. Brine covered with a layer of cottonseed oil or some other wholesome oil about $\frac{1}{4}$ inch thick will keep indefinitely. The only objection to liquid oils is the difficulty of getting at the preserved vegetables without getting them covered with the oil, which is difficult to remove. Before the vegetables are to be removed, the oil should be skimmed or siphoned off from the surface of the brine.

If oil or paraffin is used to cover the brine, it is advisable, after fermentation is finished, to adjust the amount of brine used, and the weights on the cover, so that the brine comes up to but not over the cover. In this case only the brine exposed between the cover and sides need be oiled or paraffined, thus saving covering material.

Experiments by the department have shown that the following vegetables may be preserved successfully, under home conditions, by the above method of fermentation by dry salting: Cabbage (sauerkraut), string beans, beet tops, and turnip tops, and it is probable that others may be added to this list as a result of further experiments. In general the method

described above should be followed for all vegetables preserved by this method, with modifications in the preservation of some of them as follows:

Sauerkraut or Fermented Salt Cabbage

In many parts of the country it is a general belief that only late or fall cabbage is suitable for making sauerkraut. Such, however, is not the case. If properly handled and stored, sauerkraut of excellent quality can be produced from cabbage maturing at any season of the year. The essential points are the use of only mature, sound cabbage, scrupulous cleanliness throughout the process, and proper care of the surface of the brine after fermentation is completed.

In making sauerkraut for home purposes, the outer green leaves of the cabbage should be removed, just as in preparing the head for boiling. In addition all decayed or bruised leaves should be discarded and the core removed. If an instrument for this purpose is not available it is advisable to quarter the heads and slice off the part of the core remaining on each quarter. The cabbage should be shredded by one of the hand-shredding machines sold upon the market for such purposes, or if one is not available the heads may be cut into thin slices with a slaw cutter or a large knife.

The shredded cabbage should be packed immediately into a perfectly clean, water-tight receptacle, such as a cider or wine barrel, keg, or tub. As it is packed into the receptacle, add salt in the proportion of 1 pound of salt to 40 pounds of cabbage, distributing it evenly throughout the cabbage, as described. Experiments have shown that approximately $2\frac{1}{2}$ pounds of salt to each 100 pounds of shredded cabbage give the

best flavor to the resulting kraut. When the barrel or crock is nearly full, the cabbage should be pressed down as firmly as possible and covered with a clean board cover. It is advisable but not essential that clean cloth be placed over the cabbage before the cover is put into place. The salt soon extracts a considerable amount of the cabbage juice from the cabbage, and a sufficient weight of clean brick or stone should be added to cause the brine to rise up to the wooden cover. Set the container aside until fermentation is complete, skim off any scum that forms and protect the surface by pouring over it a layer of paraffin, as described. If paraffin is not added, the scum develops very rapidly during warm weather and soon destroys the acid of the brine and the sauerkraut beneath. If the sauerkraut is made during the fall and stored in a cool place, there is no absolute necessity of a layer of paraffin, since the low temperature will prevent the growth of the organism which destroys lactic acid and causes decomposition. No doubt the popular idea that sauerkraut made from early cabbage will not keep is based upon the fact that the fermentation of sauerkraut made from such cabbage occurs in warm weather and the rapid growth of scum soon destroys both brine and kraut if the surface is not properly protected.

String Beans

String beans should be young and tender and not overgrown. Remove the tip ends and strings, cut or break the beans into pieces about 2 inches long, and pack as described on page 330. If desired, the beans may be shredded by cutting lengthwise several times, and the fermented product prepared like sauerkraut.

Beet Tops and Turnip Tops

Wash to remove grit and follow general directions as described on page 330.

Fermentation in Brine

As stated above, some vegetables which do not contain sufficient water are better fermented by covering them with a weak brine.

Wash the vegetables, drain off the surplus water, and pack them in a keg, crock, or other utensil until it is nearly full (within about 3 inches of the top of the vessel). Prepare a weak brine as follows: To each gallon of water used add ½ pint of vinegar and ¾ cup of salt and stir until the salt is entirely dissolved. The amount of brine necessary to cover the vegetables will be about equal to one-half the volume of the material to be fermented. This is very easily calculated by knowing the contents of the container used. For example, if a 5-gallon keg is to be packed, 2½ gallons will be needed. It is best to make up at one time all the brine needed on one day. A clean tub or barrel can be used for mixing the brine. Pour the brine over the vegetables, and cover as described. Set the vessel and its contents away in a moderately warm room to ferment. When fermentation has stopped, the container should be placed in a cool cellar or storeroom and the surface of the liquid treated, to prevent mold, by one of the methods described above. Before adding the paraffin or cottonseed oil, any scum or mold which may have formed on the surface of the liquid should be removed by skimming.

Experience has shown that the following vegetables may be preserved satisfactorily by fermenting in brine: cucumbers, string beans, green tomatoes, beets,

beet tops, turnip tops, corn, and green peas. The general directions given should be followed, but some modifications are desirable in the preserving of individual vegetables by this method, and these are given in the following pages.

Cucumbers

Wash the cucumbers and pack into a clean, watertight keg or crock. On the bottom of the container place a layer of dill and a handful of mixed spice. When the container is full, add more dill and spice. Add sufficient brine to cover the material. When nearly full, cover with a clean cloth and a board cover weighted with stone, as described. The dill and spices may be omitted if desired.

String Beans

Remove the ends and strings from the beans and cut into pieces about 2 inches long, pack in the container, cover with brine, and ferment, as described on page 336.

Green Tomatoes

Green tomatoes should be packed whole and prepared as cucumbers. The dill and spice may be added if desired.

Beets

Beets must be scrubbed thoroughly and packed whole. If peeled or sliced before being fermented, the beets lose considerable color and flavor.

Beet Tops and Turnip Tops

These should be washed thoroughly and packed into the container without being cut up.

Peas

Green peas should be shelled and packed in the same way as string beans. It is advisable to use fairly small containers for peas so that the quantity opened up will be used before it has a chance to spoil.

Corn

Husk and clean the silk from the corn; wash and place the ears on end in the jar, packing the jar nearly full. Pour the brine over the ears; add cover and weights. Fermented corn has a sour taste, which may not be relished if the corn is eaten alone. For this reason it will be preferable in most cases to preserve corn by canning, drying, or by salting, as described on page 339. Fermented corn, however, may be used in the preparation of some dishes, such as chowders, omelets, etc., where its flavor will be masked to some extent by the other ingredients, and the acid taste of the fermented corn may not be objectionable to some people.

Salting without Fermentation

In this method the vegetables are packed with enough salt to prevent fermentation or the growth of yeasts or molds. The following directions should be followed in salting vegetables:

Wash the vegetables, drain off the water, and then weigh them. For each 100 pounds of vegetables weigh out 25 pounds of salt. For smaller quantities use the same proportion of salt (one-fourth of the weight of the vegetables). Spread a layer of the vegetables about 1 inch deep on the bottom of a clean keg, tub, or crock, and sprinkle heavily with some of the salt. Try to distribute the salt evenly among the different layers packed so that the quantity weighed out will be

just enough to pack the vegetables. Continue adding layers of vegetables and salt until the container is nearly full and then cover with the clean cloth, board, and weight, as in the case of fermentation by dry salting. The keg or other container should then be set aside in a cool place. If the salt and pressure of the weight have not extracted sufficient brine to cover the vegetables, after 24 hours, prepare a strong brine by dissolving 1 pound of salt in 2 quarts of water and pour enough of this over the vegetables to come up to the round wooden cover. There will be a small amount of bubbling at the start, as in the case of the fermented vegetables, but this will not continue for long. Just as soon as the bubbling has stopped, the surface of the liquid should be protected by one of the methods described.

Experiments have shown that the following vegetables may be satisfactorily preserved by the above method: dandelions, beet tops, turnip top, spinach, chard, kale, cabbage, string beans, green peas, and corn. The string beans should be cut in 2-inch pieces, as in their preparation for fermentation. The peas should be shelled and packed according to the directions given above. Cabbage should be shredded and packed in the same way as in the manufacture of sauerkraut. Corn, however, requires somewhat different treatment, and the directions for salting it are as follows:

Salted Corn

Husk the ears of corn and remove the silk. Cook in boiling water for about 10 minutes to set the milk. Cut off the corn from the cob with a sharp knife. Weigh the corn, and pack in layers with one-fourth its weight of fine salt, as described above.

Care and Storage of Fermented and Salted Products

If properly prepared and stored, fermented and salted products will keep for a long time. It is absolutely necessary to prevent mold from growing on the surface of the brine of fermented vegetables by the addition of paraffin or in some other way, as described. Protection of the surface of salted vegetables is desirable, but not necessary if the containers are covered to prevent the evaporation of the brine. Practically all of the trouble with the fermented or salted products may be traced to carelessness in protecting the surface of the brine. In case mold should develop upon the surface, or the brine should become evaporated so that the upper layers of the food spoil, this does not mean necessarily that the entire contents of the vessel has spoiled, even though the upper layers may have a very disagreeable odor. The molds and other organisms which cause the spoiling do not penetrate rapidly to the lower layers, and by carefully removing the spoiled material from the top, adding a little fresh brine and pouring hot paraffin on the top, the remainder of the contents of the vessel may be saved. After fermentation has ceased, the containers of salted and fermented vegetables should be stored in a cool place. They should be protected from rats, mice, and vermin, which might eat through the paraffin layer and get at the contents.

Preparation of Fermented and Salted Vegetables for the Table

Some fermented and salted vegetables, like cucumbers, are eaten raw; others, like cabbage (sauerkraut), are usually cooked. In general the fermented and

salted products may be prepared for the table in much the same manner as the fresh vegetables, except that before being cooked they should be soaked in fresh water for several hours or longer, if necessary, to remove the salt, the water being changed several times. In some cases it may be necessary also to change the water once or twice during the boiling of the salted vegetables. In this, one should be guided by taste.

Fermented vegetables, after being removed from the container, should be rinsed thoroughly in fresh water and then cooked without soaking if a product having a decidedly acid flavor is desired. If one does not desire the acid flavor, it may be modified to any extent or removed almost entirely by soaking the fermented vegetables as directed above for the salted product.

The following suggestions and recipes are given as a guide in the preparation of salted and fermented vegetables for the table. These have been tested and found to give satisfactory results.

Dandelions, Spinach, Kale, and Other Greens

The salted greens, after they have been soaked to remove the salt, may be boiled with fat meat, or boiled plain, served with a cream sauce and garnished with hard-boiled eggs. When so prepared they taste much like the fresh greens, although, naturally, they lose some of their flavor during the salting and freshening process.

The fermented greens may be soaked and cooked in the same way as the salted greens, but, in general, it is desirable to cook them without soaking and to preserve the acid flavor, which is very similar to that of the fresh greens when boiled and served with vinegar.

Beets

Rinse the fermented beets and boil in the same manner as fresh beets. When thus prepared they have a flavor which is not unlike the common pickled beets, and they may be served as a pickle, with butter, or used in the preparation of salads, vegetable hashes, etc.

String Beans

The salted string beans should be soaked to remove the salt and then cooked in any of the ways in which fresh string beans are prepared. The fermented string beans may be cooked without soaking and served as a vegetable or as an ingredient of a salad, the acid flavor being agreeable to many persons. Young and tender string beans may be fermented and eaten raw in the same way as cucumber pickles.

Corn

To prepare the fermented or salted corn for the table, rinse it thoroughly and soak it for 4 or 5 hours, changing the water frequently. In general it will be found more satisfactory to remove practically all of the acid flavor from the fermented corn. After soaking, place the corn in cold water and bring to boil, pour off the water, add fresh cold water, bring to boil again, and cook until tender. The cooked salted or fermented corn may be used in the following recipes which are given below, or may be served as stewed corn or succotash.

CORN CHOWDER

¾ pound cold beef, or	1 cup tomatoes.
¼ pound salt pork or bacon.	3 tablespoons flour.
2 potatoes.	1 cup milk or cream.

1 onion.
½ green pepper.
1½ cups or more of cooked corn.
1 teaspoon salt.
¼ teaspoon pepper.

Cut the meat or pork into cubes; cover well with water. Add the tomato and cook slowly for about two hours. Then add the potato, onion, pepper, corn, and seasonings. Cook until the vegetables are tender. Mix the flour with a little cold water, add to the other ingredients and cook slowly for 5 or 10 minutes. Add the milk or cream; serve hot.

SCALLOPED TOMATOES WITH CORN

2 cups canned tomatoes.
1 teaspoon salt.
¼ teaspoon pepper.
2 tablespoons sugar.
1 cup bread crumbs.
2 cups salted or fermented corn.

Cover the bottom of the greased baking dish or casserole with a layer of bread crumbs; add a layer of the corn and one of tomatoes. Continue this until all materials have been used up, saving a layer of bread crumbs for the top. Dot with butter and brown in a hot oven.

CORN PUDDING

2 eggs.
1 pint milk.
1 tablespoon sugar.
2 cups cold cooked corn.
2 tablespoons melted butter or other fat.
½ teaspoon salt.

Beat the eggs until light and add the sugar, corn, milk, melted butter, and salt. Pour into a buttered baking dish and bake in a slow oven until firm. Skim milk may be used in this dish.

CORN OMELET

4 eggs.
½ teaspoon salt.
4 tablespoons hot water.
1 tablespoon butter.
1 cup cold cooked corn.

Separate yolks and whites of eggs. To the yolks add the salt, pepper, and hot water, beat until thick, and then add the corn. Fold the stiffly beaten whites into the first mixture. Cook the omelet slowly in a buttered pan until a delicate brown.

CORN FRITTERS

2½ cups cooked corn.
1 cup flour.
1 teaspoon baking powder.
2 teaspoons salt.
¼ teaspoon paprika.
2 eggs.

Chop the corn. Mix and sift dry ingredients and add chopped corn and the well-beaten egg yolks, and then fold in the stiffly-beaten whites. Bake on well-greased griddle or in a frying pan until a golden brown. Drain on brown paper. Serve hot with butter or sirup.

CORN WAFFLES

1¾ cups flour.
⅔ cup cooked corn.
1½ cups milk.
2 tablespoons sugar.
4 teaspoons baking powder.
¾ teaspoon salt.
1 tablespoon butter.
1 egg.

Mix and sift dry ingredients. Add the corn and mix thoroughly. Add the milk, yolk of egg well beaten, butter, and stiffly beaten egg white. Bake in greased, hot, waffle iron until golden brown.

Peas

Salted or fermented peas should be soaked to remove most of the salt or acid flavor, and may then be served in the same way as fresh green peas. The following recipes have been found satisfactory for using the salted or fermented peas:

PURÉE OF PEAS

2 cups salted or fermented peas.
½ cup whole or skim milk.
1 teaspoon salt.
1 tablespoon butter or other fat.
Paprika.

Boil the peas until tender, press them through a sieve to remove skins, and put into a saucepan. Add ½ cup warm milk (or skim milk), 1 teaspoon salt, and a little paprika. Mix well and cook for five minutes. Serve hot.

PEA TIMBALES

- 2 cups salted or fermented peas.
- 2 eggs.
- 2 tablespoons melted butter or other fat.
- ½ teaspoon salt.

Boil the peas until tender and rub through a sieve. Add the eggs well beaten, salt, a little pepper, and a few drops of onion juice. Turn into greased molds and cover them with greased paper. Set the molds in a pan of hot water and bake in the oven until firm. Serve with white sauce.

U. S. DEPARTMENT OF AGRICULTURE
FARMERS' BULLETIN NO. 879

HOME STORAGE OF VEGETABLES

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Contribution from the Bureau of Plant Industry
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INTRODUCTION

For those persons who are fortunate enough to control land for the growing of vegetables in sufficient quantity for the needs of the family, storage will prove an economy. Likewise, it will often prove an economy to grow late vegetables to store. Home storage is of importance at all times, but especially so if the price of suitable containers for use in canning and drying is high. Crops of suitable sorts that mature at a season when they can be preserved by storing, should be kept in their natural condition instead of being canned or dried. Not only is it possible to reduce the cost of the menu materially by growing and storing

vegetables for home use, but the satisfaction of having a supply of fresh vegetables near at hand, so that regardless of markets and winter temperatures the list may be varied, is something that can not be measured in dollars and cents.

A half-acre garden, if cared for properly, will produce far more vegetables than the average family can consume during the maturing period of the crops. Only a small portion of the garden should be devoted to those vegetables which must be used as soon as they reach maturity. Beets, late cabbage, carrots, celery, onions, parsnips, potatoes, sweet potatoes, salsify and turnips may be stored in their natural condition, and should be grown, to the extent of the family needs, for storage for winter use. Beans of various kinds, including the Limas, may be stored dry. The successful storage of vegetables is not at all difficult; in fact, good storage facilities already exist in most homes, it being only necessary to make use of the cellar, the attic, a large closet, or some other part of the dwelling, depending upon the character of the product to be stored.

Types of Storage

A Storage Room in the Basement of the Dwelling

A cool, well-ventilated cellar under the dwelling offers good conditions for the storage of vegetables. Many cellars are not well suited for storing vegetables because of poor insulation or lack of ventilation. Cellars containing a furnace for heating the dwelling, usually are too warm and too dry for the storage of root crops. It is often possible, however, to partition off a room, either in one corner or at one end of the cellar, where the temperature may be controlled by means of out-

side windows. At least one window is necessary, and two or more are desirable for admitting light and for ventilation.

CONSTRUCTION OF THE STORAGE ROOM

The size of the storage room should be determined by the space available and the amount of material to be stored. Natural earth makes a better floor than concrete or brick, as a certain amount of moisture is desirable. The walls of the storage room should be parallel to the walls of the cellar. Lay 2- by 4-inch scantling flat on the floor; and secure them with pegs driven into the floor, or by nailing them to the top of short posts set in the ground. Set 2- by 4-inch studding from the sill to the ceiling, spacing them 16 inches apart from center to center. Locate the door to the storage room at the most convenient point, making it large enough to admit barrels, boxes, etc., a good size being $2\frac{1}{2}$ feet wide by $6\frac{1}{2}$ feet high. Set the studs on either side of the door 32 inches apart, which will allow for the door and the frame. Put a header over the door, allowing 1 inch for the frame and $\frac{7}{8}$ inch for the sill at the bottom. Set the studs against the walls where the cellar walls and storage-room walls meet. Care exercised in making the frame square and plumb will enable the builder to get the structure tight with a minimum of labor. A good room is made by covering the studding on the outside with tongue-and-groove material, but a better way is to sheathe the outside with plain lumber, tack building paper on this, and side with tongue-and-groove material. This construction, in connection with lath and plaster or wall board on the inside, makes an excellent room.

Ventilation may be secured by opening one or more

windows. An air duct constructed of wood, metal, or terra cotta, and fitted in one of the windows, is desirable, as it permits the cool air to enter at the bottom of the room. Two or more joints of 6-inch stovepipe, one with a damper and an elbow, may be used. A piece of board with a hole the size of the pipe is fitted in the window in place of one of the panes of glass. Another pane of glass may be removed from the sash and a small hinged door fitted in its place, which, when opened, allows the heated air to escape. In cold weather both the hinged door and the damper in the stovepipe must be closed. The windows in the storage room should be darkened in order to protect the vegetables from the light.

Barrels, crates, boxes, or bins may be used as containers for the various vegetables, but movable containers are preferable to built-in bins, as it is possible to remove them for cleaning. It is advisable to construct shelves or a slat floor to keep the crates, boxes, baskets, and other containers off the ground. This is highly desirable, to insure a free circulation of air and to prevent the containers from harboring mice, rats, and other vermin. The shelves for canned goods along one side of the room need not be more than 6 inches wide.

Outdoor Storage Cellars

Outdoor storage cellars or caves are excellent for the storage of many vegetables. They are particularly desirable on the farm, as they afford convenient and inexpensive storage facilities for surplus vegetable crops that otherwise might be lost. They possess all the advantages of the storage room in the basement and are superior in many respects. The outdoor

storage cellar can be maintained at a uniform temperature over a long period. It is possible to keep the cellar cool, and quickly to reduce the temperature of the stored product to the desired point for safe storage, by opening the door during the night and closing it in the morning before the air becomes warm. All ventilators should likewise be kept tightly closed until the outside air is again cooler than that within the cellar, when they should be opened, unless the outside temperature is so low as to be dangerous. This safeguards the product and adds to the efficiency of the storage chamber. Vegetables can be more conveniently placed in such a cellar than in the storage room in the basement of a dwelling.

When the chief use of the outdoor storage cellar is for storing turnips, beets, carrots, and other root crops commonly used as stock food, it should be located near the stable, where the material will be convenient for winter feeding. When it is to be used for vegetables for the table, the cellar should be accessible from the kitchen at all times. If apples or other fruits are to be stored in an outdoor storage cellar it is desirable to have a two-compartment cellar, one for vegetables and one for apples, with a ventilating apparatus in each compartment.

CONSTRUCTION OF THE OUTDOOR STORAGE CELLAR

As the root cellar must be weatherproof, that is, capable of being kept free from moisture and free from frost, its type and construction vary with the geographical location. In the southern portion of the country the structure is usually entirely above ground, and is protected by only a few inches of sod and with straw, leaves, etc. In northern sections outdoor

storage cellars are made almost entirely below ground and covered with a foot or two of earth.

STORAGE IN REGIONS OF MILD WINTERS

An aboveground storage cellar suited to conditions in southern sections of the United States may be built on a well-drained site at slight expense. A row of posts may be set 5 or 6 feet apart, extending 7 or 8 feet above the surface of the ground, with a ridgepole placed on top of them. Against each side of the ridgepole a row of planks or puncheons is placed, with their opposite ends resting in a shallow trench 4 or 5 feet from the line of posts. The ends are boarded up, a door being provided in one end of the structure, and the roof covered with sod to a depth of 5 or 6 inches.

STORAGE IN REGIONS OF SEVERE FREEZES

In sections where low temperatures prevail it is necessary to insulate the storage house, so that the vegetables will not freeze. An aboveground type of storage house much used in many sections of the North has thick walls filled with insulating material, such as sawdust or shavings. The construction is of frame, and the walls are usually 10 to 12 inches thick. Both the inside and the outside walls are sheathed with matched lumber so as to make them air-tight. The rafters are ceiled on the under side with the same material and the space between the rafters filled with dry insulating material. The use of building paper in the roof and walls of the storage house is of great assistance in insulating. Ventilation is provided in the same manner as in the outdoor storage cellar built of concrete.

A type of storage cellar much used in northern sections of the country is built partly under ground. The walls are of masonry and extend to a point just above the surface of the ground. On these walls, plates are set and a roof of frame construction erected. The roof structure is ceiled on the under side of the rafters, and some suitable insulating material, such as dry sawdust or shavings, packed in the space between the rafters; and then the sheathing, paper, and roofing material are applied as in the case of the aboveground type of storage cellar described in the previous paragraph. This type of structure is preferable in many respects to the aboveground type, as it is easier to maintain the temperature at the proper point and its insulation is a comparatively easy matter.

Protection from freezing may be secured with a simpler type of structure by making it entirely under ground. In order to avoid steps down to the level of the floor, with the consequent extra labor in storing and removing the vegetables, a sidehill location is desirable.

The excavation in the hill should be of the approximate size of the cellar, using the dirt for covering the roof and for banking the sides of the structure. A frame is erected by setting two rows of posts of uniform height in the bottom of the pit near the dirt walls, and a third line of posts, about 5 feet higher, through the center of the pit. These posts serve as supports for the planks or puncheons forming the roof of the structure, as with the above-ground type of storage cellar already described. The door is placed at one end and a ventilator put in the roof. The whole structure, with the exception of the portion occupied by the door, is covered with dirt and sod. The thickness of the covering must be deter-

mined by the location; the colder the climate the thicker the covering. The dirt covering may be supplemented in winter by a layer of manure, straw, corn fodder, etc. Outdoor storage cellars usually are left with dirt floors, as a certain degree of moisture is desirable. These cellars may also be made of concrete, brick, hollow tile, stone, or other material.

OUTDOOR STORAGE CELLARS BUILT OF CONCRETE

The type of outdoor storage cellar described above, while low in first cost, is short lived, as the conditions in the cellar are favorable to the decay of wood. The concrete storage cellar, although rather high in first cost, as compared with wood, is a permanent structure. Concrete possesses several advantages over brick, stone, or other decay-resisting materials. In the construction of a small structure suitable for the home, it is possible to make the roof self-supporting and to employ unskilled labor, thus lessening the cost. It is a simple matter to waterproof concrete, a feature highly desirable in a storage cellar.

For detailed information in reference to the mixing and handling of concrete, the reader is referred to Farmers' Bulletin 461, entitled " The Use of Concrete on the Farm."

The site for the concrete storage cellar should be selected with the same considerations in mind as for the wood-frame cellar, namely, a well-drained convenient location, preferably a sidehill, into which it may be built. The excavation should be just large enough for the dirt walls to serve as the outside form for the concrete. For that portion of the wall which is above the surface of the ground, a board form must be used. The inside form usually is made of boards

held in place by scantling spaced about 18 inches apart. Temporary supports should be placed across the top to carry the form, so that it will be of size and shape desired. The side walls and roof should be so constructed that there will be no joints to weaken the structure. The form for the ceiling may be slightly arched by setting a temporary line of posts through the middle of the excavation. A plate placed on these posts a few inches higher than the height of the side walls, will allow the form boards to be laid crosswise of the cellar, springing the ends down and securing them to the forms for the inside of the walls. An arch a few inches high makes a strong roof and helps in ventilating the cellar.

The whole structure, with the exception of the portion occupied by the door, is covered with earth to prevent freezing, the thickness of the earth covering depending upon the geographical location. In the colder sections of the country 2 or 3 feet is not too much, and additional protection may be given by using a supplementary covering of straw, fodder, or manure. In severely cold weather, both the top and bottom air ducts must be closed. It is well to cover the outside ends of the air inlets by woven wire in order to prevent small animals from entering the storage cellar.

A popular type of cellar is 10 feet wide, 12 feet long, and 8 feet high and will contain the products of an acre garden. The walls are of 6-inch concrete reinforced by $\frac{5}{8}$-inch iron rods. The floor is earth, as this permits good moisture conditions for the storage of vegetables. The structure is provided with a ventilating flue in the roof and an air inlet in the floor for the admission of cool air.

The storage capacity may be increased by making

the structure longer, but when this is done additional ventilators must be provided. If the width is increased, either middle piers should be used to assist in carrying the roof, or the roof should be arched. A cellar 6 feet wide, 8 feet long, and 7 feet high will provide the necessary storage space for the products of a small home garden and may be built in the same manner as the one described above.

THE STORAGE CELLAR UNDER AN OUTBUILDING

Sometimes it is possible to build a storage cellar as the lower story of, and foundation for, an outbuilding. When this is done it is desirable to have the cellar almost entirely under ground and well insulated by banking the outside walls with dirt. The ceiling of the cellar may be made frostproof by constructing a double wall to be filled with dry sawdust, shavings, or other insulating material. Concrete is a good material of which to construct the side walls of the cellar, although brick, stone, tile, etc., may be used. The entrance may be through the floor of the room above, or through an outside door placed in one end of the cellar and reached by steps or a grade entrance. Ventilation may be secured by placing a shaft from the ceiling of the cellar through the room above to the roof, or by placing the ventilators in the side walls near the ceiling. The inlet ducts should be put in the floor, as in other outdoor concrete cellars, and their outer ends covered with wire screen.

Storage in Banks or Pits

Outside banks or pits are used very generally for keeping vegetables. The conical pit is used commonly for such vegetables as potatoes, carrots, beets, turnips,

salsify, parsnips, and heads of cabbage; and is constructed as follows: A well-drained location should be chosen and the product piled on the surface of the ground; or a shallow excavation may be made of suitable size and 6 or 8 inches deep, which may be lined with straw, leaves, or similar material, and the vegetables placed on the litter in a conical pile. The vegetables should then be covered with straw or similar material and finally with earth, to a depth of 2 or 3 inches. As winter approaches, the dirt covering should be increased until it is several inches thick. The depth of the earth covering is determined by the severity of the winters in the particular locality. It is well to cover the pits with straw, corn fodder, or manure during severely cold weather.

The amount of ventilation necessary will depend upon the size of the pit. Small pits containing but a few bushels of vegetables will receive sufficient ventilation if the straw between the vegetables and dirt is allowed to extend through the dirt at the apex of the pile. This should be covered with a board or piece of tin held in place by a stone to protect it from rain. In larger pits ventilation may be secured by placing two or three pieces of rough boards or stakes up through the center of the pile of vegetables, so that a flue is formed. This flue is capped by a trough formed of two pieces of board nailed together at right angles.

Vegetables keep very well in sucn pits, but it is difficult to get them out in cold weather, so that when a pit is opened it is desirable to remove its entire contents at once. For this reason it is advisable to construct several small pits rather than one large one, and instead of storing each crop in a pit by itself it is better to place a small quantity of several kinds of

vegetables in the same pit, so that it will be necessary to open only one bank to get a supply of all of them. In storing several crops in the same bank, it is a good plan to separate them with straw, leaves, or other material. The vegetables from the small pit may be placed temporarily in the storage room in the basement, where they will be easily accessible as needed for the table.

Storage of Various Vegetables

Beans and Peas

Beans may be kept for winter use by picking the pods as soon as they are mature and spreading them in a warm, dry place, such as an attic floor, until the beans are thoroughly dry. Then shell, and store in bags hung in a dry, well-ventilated place until needed. Allow navy and other bush beans to mature on the vines until a maximum number of pods are ripe; then pull the whole plant and cure it like hay. After thorough drying, thrash the beans, and store as suggested above.

Peas may be treated like bush beans and stored in the same manner.

Late Beets

Storage for beets may be of any of the types described. The beets should be pulled and the tops cut off when the soil is dry. If they are to be kept in the storage room in the basement or in an outdoor storage cellar, they should be placed in ventilated barrels, loose boxes, or, better still, in crates. If sufficient space is available in the cellar, it is a good plan simply to place them in small piles along the wall. Storage in large

piles should be avoided, as it is liable to cause heating and decay.

For storage in banks or pits, prepare the beets as for storage in the room in the basement or in the outdoor cellar. Select a well-drained location, make a shallow excavation, about 6 inches deep, line it with straw, hay, leaves, or similar material, and place the beets in a conical pile on the lining. Make the bottom of the pile about the same size as but not larger than the bottom of the excavation. Cover the beets with the same material as that used for lining the bottom of the pit, and carry it up several inches above the apex of the pile of vegetables, having it extend through the dirt covering. This serves as a ventilating flue, and it should be covered with a piece of tin or a short board as a protection from rain. The dirt covering should be 2 or 3 inches thick when the vegetables are stored, and it should be increased as severely-cold weather approaches, until it is a foot or more in thickness. In finishing the pit, the dirt should be firmed with the back of the shovel in order to make it as nearly waterproof as possible.

The shallow trench around the base of the pit should have an outlet for carrying off the water. Supplement the dirt covering with manure, straw, corn fodder, or other protecting material. Use several small pits instead of one large one, as vegetables keep better in small pits and the entire contents may be removed when the pit is opened.

Late Cabbages

Heads of late cabbage may be cut and stored in conical pits in the same manner as beets. Another

common and very satisfactory method is to pull the plants, roots and all, and place them in a long pit with the heads down. A few heads may be removed from time to time without disturbing the remainder of the pit. As slight freezing does not injure the cabbage, the covering of the pit need not be as thick as for other vegetables.

Another good method of storing cabbage is as follows: The plants are pulled, roots and all, and set side by side, with the roots down, in a shallow trench, the length of which corresponds to the width of the bed. The bed may be any width up to 8 or 10 feet and as long as necessary to hold the number of cabbages to be stored. Cover the roots with earth. Around the bed erect a frame of rails, boards, or poles, or consisting of a row of stakes driven into the ground, so that an inclosure about 2 feet in height is formed. Bank the outside of this frame with dirt, and place poles across the top, covering them with straw, hay, or corn fodder. Make provision for removing portions of the stored product from one end of the pit. This type of storage is inexpensive and gives good results. When the heads are cut, leave the roots in position, and in the spring these roots will sprout and supply the family with an abundance of greens. A large percentage of the cabbage sprouts found on the market are produced in this way.

Heads of cabbage may be laid in rows on shelves in an outdoor storage cellar, but not in a storage room in the basement of a dwelling, as the odor is likely to penetrate through the house.

For information regarding the storage of cabbage on a large scale, see Farmers' Bulletin 433, entitled "Cabbage."

Carrots

Carrots may be stored in a storage room in the basement, in outdoor storage cellars, or in banks or pits, and are handled in the same way as beets. It is advisable to place a small quantity in the storage room in the basement or in the storage cellar, and the remainder in banks or pits. They are not injured by slight freezing; hence need not be covered as deeply as potatoes.

Late Celery

Celery may be stored for a time in the position where grown, by placing enough earth around the base of the plants to hold them in good form. Allow them to remain in this condition until just before severe freezing occurs; then bank the earth up to the very tops of the plants, almost covering them, and as the weather becomes colder cover the ridge with coarse manure, straw, or corn fodder, held in place by means of stakes or boards. The celery may be removed as needed, but this method is open to the objection that it is hard to get the celery out when the ground is frozen.

Another method of storing celery is to excavate a pit 10 to 12 inches wide to a depth of about 24 inches and of any desired length; thoroughly loosen the soil in the bottom, or shovel in loose topsoil to form a bed in which to set the roots of the celery; and pack this trench with fully grown plants, placing the roots close together with considerable soil adhering to them. Water the celery as it is placed in the trench and allow the trench to remain open long enough for the tops to become dry. Unless the soil is very dry at the time of storing, or extended warm weather should follow, it will not be necessary to apply more water. Place a 12-inch board on edge along one side of the trench,

and bank it with the surplus earth; cover the trench with a roof of boards, straw on poles, or cornstalks from which the tops have been removed, placing the stalks across the pit with one end resting on the board and the other on the ground; spread over this a light covering of straw or other material which will pack closely, and as the weather becomes colder increase the covering to keep out the frost. Celery stored in this manner will keep until late in the winter. This method, because of its simplicity, is recommended for the farmer and small grower.

The unused pit of a permanent hotbed may be utilized as a storage place for celery, by removing the surplus earth and substituting a covering of boards for the sash. Store the celery in the same manner as in the trench, and cover the bed with any material which will keep out frost.

Celery may be stored on the floor of a storage room in the basement of a dwelling or in an outdoor storage cellar. Take up the plants just before freezing occurs, with considerable earth adhering, and set them on the floor with the roots packed together as closely as possible. If moderately moist, the celery will keep well under the conditions found in most storage cellars. Celery should not be stored in the same cellar as turnips or cabbage, as it will absorb the odor of these vegetables, ruining its flavor.

For further information regarding the cultivation and storage of celery, see Farmers' Bulletin 282, entitled "Celery."

Onions

To keep well, onions must be mature and thoroughly dry. Put them in ventilated barrels, baskets, crates,

or loosely woven bags, as good ventilation is essential to the keeping of onions. A dry, well-ventilated place, such as an attic, furnishes a good storage space for onions, as slight freezing does not injure them, provided they are not handled while frozen.

For further information regarding the storage of onions, see Farmers' Bulletin 354, entitled "Onion Culture."

Parsnips

Parsnips may be allowed to remain in the ground and dug as needed, as freezing does not injure them. However, as it is a difficult matter to dig them when the ground is frozen, it is advisable to store a small quantity in the storage room in the basement of the dwelling, or in the outdoor storage cellar, for use during the period when the ground is frozen. Parsnips may be stored in the same manner as beets and carrots.

Potatoes, Irish

The Irish potato is the most important vegetable in the northern portions of the United States and is stored in large quantities for winter use. It may be kept in the storage room in the basement, in outdoor storage cellars, and in banks or pits. When stored in cellars, the potatoes may be put into barrels, boxes, baskets, crates, bins, or on the floor, but must be protected from the light. When stored in banks or pits they are handled in the same way as beets, carrots, etc. Potatoes must be protected from freezing, and before winter sets in, the pit must be covered with manure, straw, or other material in addition to several inches of earth. It is a good plan to place the major portion of the crop in banks or pits, and a small quantity in

the storage room in the basement or in the outdoor storage cellar, for immediate use.

For more detailed information on the storage of potatoes, read Farmers' Bulletin 847, entitled "Potato Storage and Storage Houses."

Potatoes, Sweet

Sweet potatoes should be mature when dug, and should be left exposed for a few hours to dry off the surface moisture before being placed in storage. They should be handled carefully at all times, as they are bruised easily. This crop may be kept in pits or banks or in outdoor storage cellars, but a warm, dry place is preferable. When stored in pits or banks, sweet potatoes are handled in much the same way as beets or other root crops. When kept in a specially constructed storage house, either in bulk or in crates, the potatoes should be cured for about 10 days or 2 weeks at a temperature of 75° to 80° F. After the curing period the temperature should be reduced gradually to about 55° F. and maintained at that point, or as near it as practicable, for the remainder of the storage period. When well matured before digging, carefully handled, well cured, and held at a uniform temperature of about 55° F., sweet potatoes may be kept throughout the winter and spring. When only a few bushels of sweet potatoes are to be stored, they may be placed in the basement near the furnace, on a shelf near the kitchen stove, near the chimney on the second floor, or even in the attic.

For more detailed information on the storage of sweet potatoes, read Farmers' Bulletin 548, entitled "Storing and Marketing Sweet Potatoes."

Pumpkins and Squashes

Pumpkins and squashes may be kept for winter use in the storage room in the basement or in dry, well-ventilated cellars, but a dry, aboveground, frostproof place is best. Put them in rows on shelves so that they are not in contact with each other. If the temperature is maintained at about 40° F., late-maturing varieties of these vegetables will keep until late in the winter.

Salsify

Salsify may be stored in the same way as beets, carrots, and parsnips.

Late Turnips

Turnips will withstand hard frost, but alternate freezing and thawing injures them. Gather, top, and store the roots in banks or pits, or in an outdoor storage cellar. Do not place them in the storage room in the basement of the dwelling, as they give off odors that penetrate throughout the house.

Storage of Apples

Apples may be kept in the storage room in the basement of the dwelling, in outdoor storage cellars, and in banks or pits. Conditions suitable for the keeping of potatoes answer fairly well for apples. Under some conditions it will be an advantage to store part of the crop in the cellar, and the late-keeping varieties suitable for spring use in outdoor banks or pits.

For further discussion of the storage of apples, see Farmers' Bulletin 852, entitled "Management of Common Storage Houses for Apples in the Pacific Northwest."

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